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American Machinist

Volume 36, No. 14.
Issued Every Thursday.
Hill Publishing Company.

NEW YORK, APRIL 4, 1912.

Price, 15 Cents.
Reading Index, 225.
Advertising Indexes, 83.

Proved By Comparative Tests

The results of these tests are described in detail by Mr. Samuel S. Roberts, testing engineer of the Carnegie Steel Co., on pages 172 and 173 of the American Machinist, February 1, 1912.

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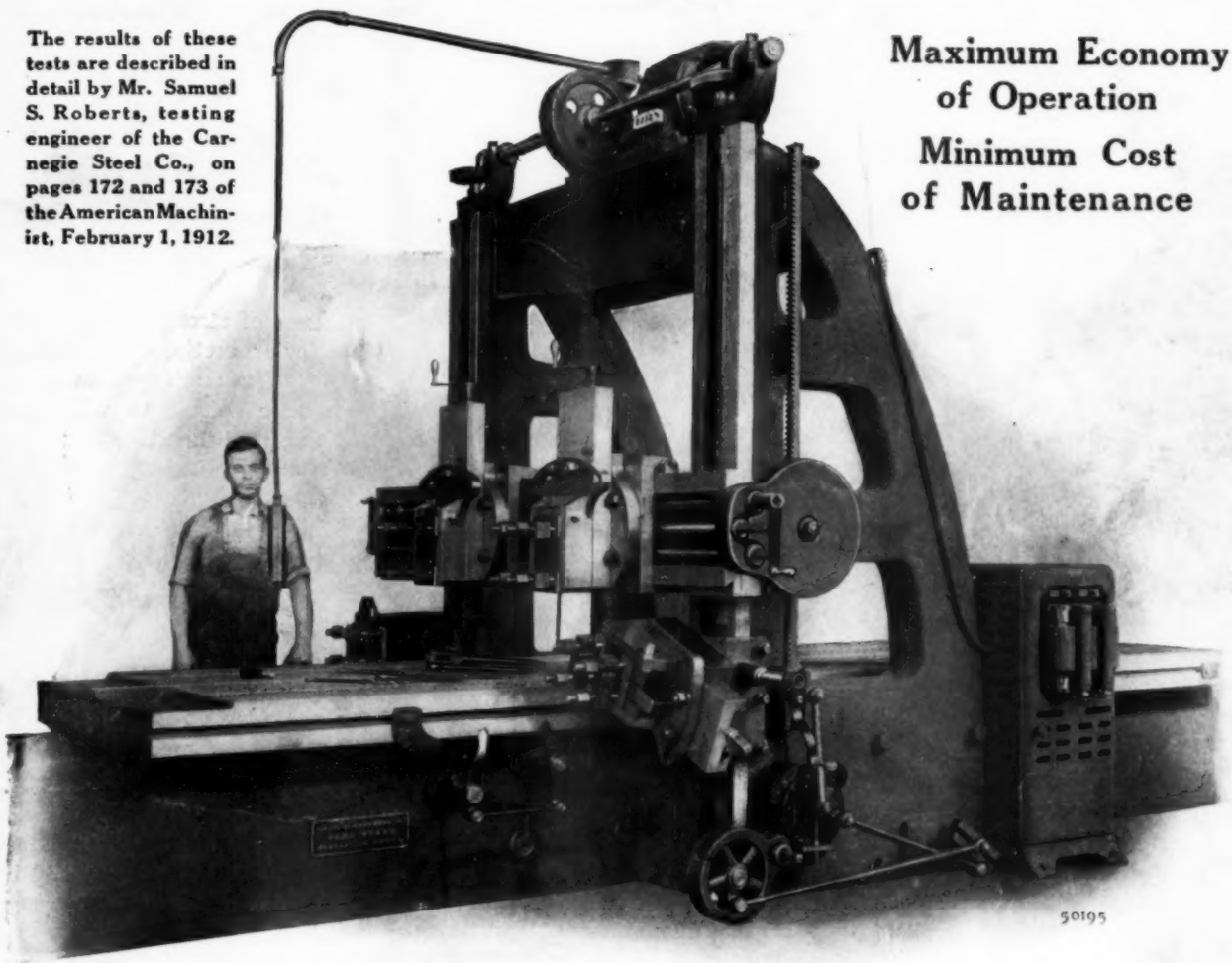
Minimum Cost of Maintenance



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The Pond Reversing Motor Planer

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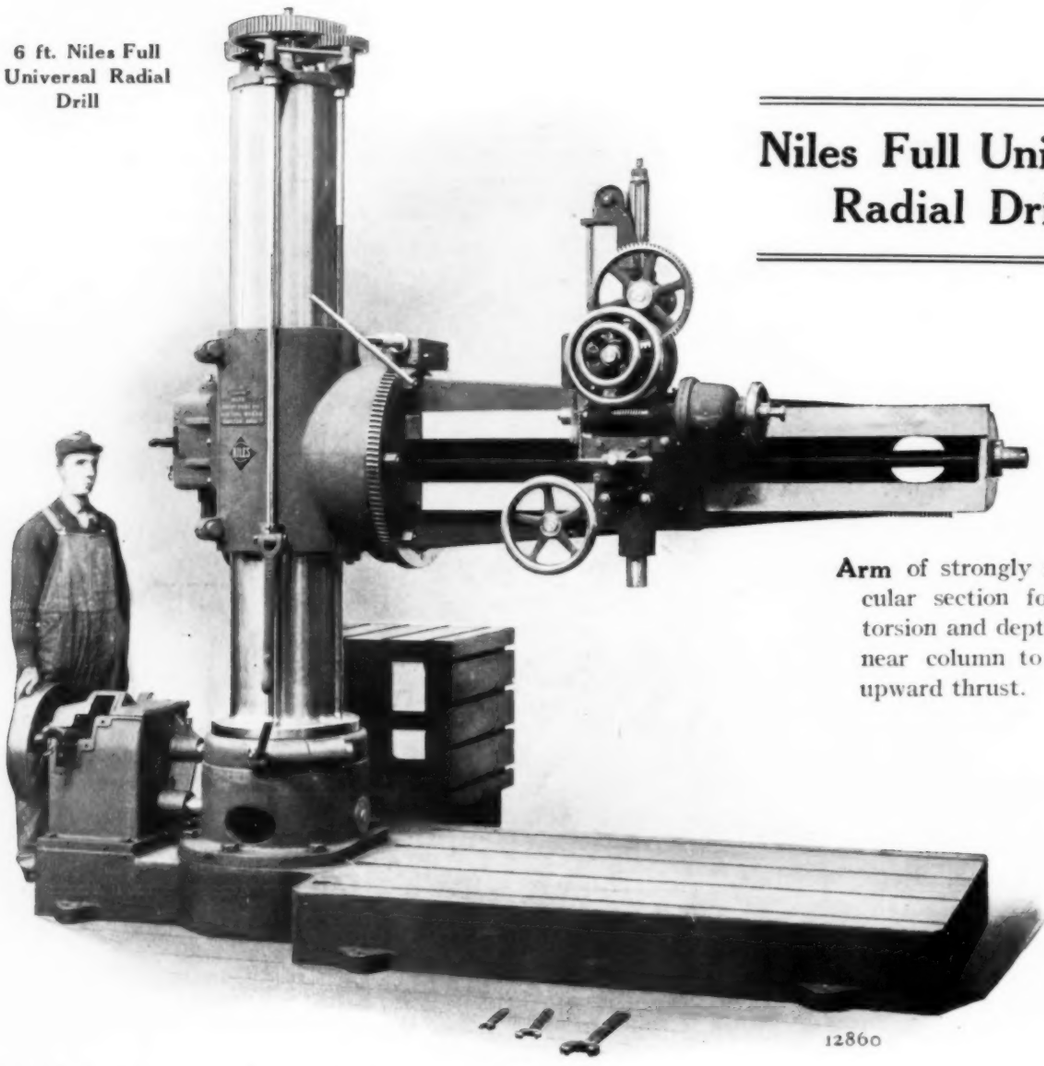

12860

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A Missouri Gas Engine Factory

By F. A. Stanley

Method of milling engine bases with horizontal and vertical cutters on the same machine, and jig-drilling and tapping under three-spindle driller.

A special valve grinder, and a method of turning crankshafts on a plain lathe without gearing.

Machining flywheels and polishing cylinders.

One of the old-established firms in Kansas City, Mo., is the Witte Iron Works Co., which for many years has made a specialty of the manufacture of gas and gasoline engines. Quite naturally there are many features of interest in connection with the methods of this firm and the purpose of the accompanying halftones is to illustrate a few tools and operations observed during a recent visit to the Witte plant.

Milling and Jigging Bases

The engines built by this company have a cylinder cast separately from the base and attached to a surfaced seat which locates it properly and permits the cylinder to be easily replaced in the event of an accidental break through expansion.

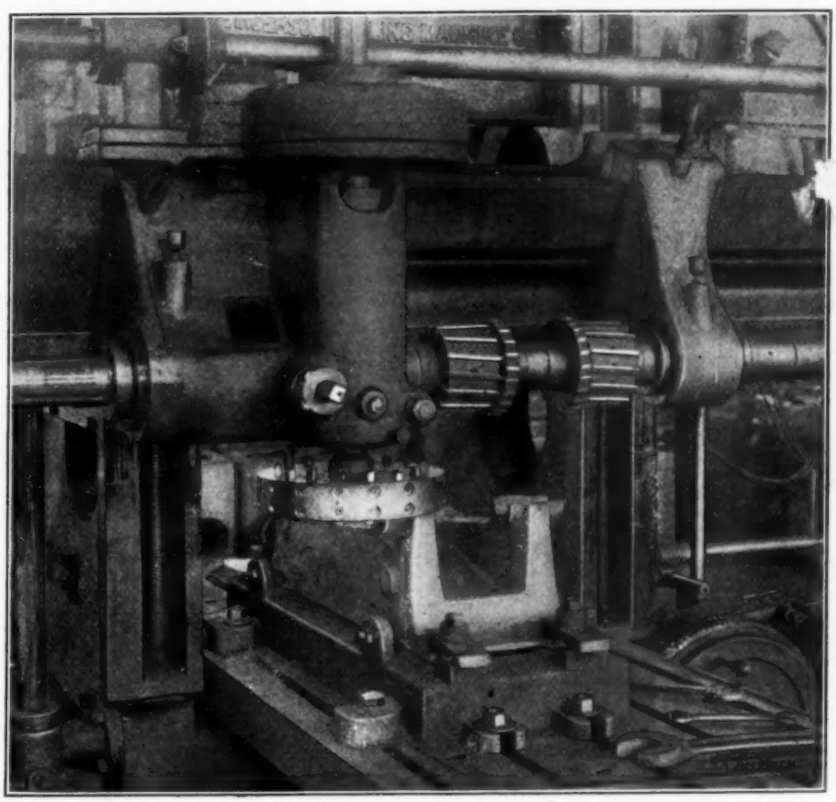


Fig. 1. Milling a Gas-engine Base

The Ingersoll miller in Fig. 1 is used for machining the cylinder seat and for facing the seats for the bearing caps.

The four cutters in the gang on the main spindle of the miller accomplish the operation of surfacing the tops and inner edges of the cylinder seats on the base so that the pads on the sides of the cylinder will rest properly on the base and the locating tongue under the pads will fit between the milled edges and so position the cylinder laterally.

The facing cutter on the vertical spindle is fed crosswise of the miller to machine the seats for the caps, and this operation is the one shown under way in the illustration. All sizes of bases are handled in this manner on the miller and suitable holding fixtures are also employed to allow the casting to be set correctly and clamped as rapidly as possible.

A simple type of drill jig for locating the stud holes in the base for caps and cylinder is shown in Fig. 2. This jig is a cast plate with the necessary guide bushings and with simple means of attaching to the work. The base is drilled and tapped in a three-spindle Rockford driller with a large table to permit the casting to be slid easily under the different spindles.

A Valve Grinder

The valve case, which is attached to the cylinder carries a vertical valve which is ground into its seat with the special machine illustrated in Fig. 3.

The valve case is placed upon the small table at the right which is elevated or depressed by two screws connected by a pair of sprockets and a chain. The machine spindle by which the valve is oscillated is actuated by a rack which is reciprocated by a crank on the driving shaft, the rack engaging with a small pinion mounted upon the spindle.

The driving shaft derives its motion from a three-step cone pulley and belt and three rates of oscillation may thus be imparted to the valve, according to requirements. The valve case is manipulated by hand to apply the desired pressure between the valve and seat during the grinding-in process.

Turning Crankshafts

Small crankshafts are machined in a Le Blond lathe with the counterbalanced fixtures shown in Fig. 4, for holding the shaft for the turning of the pin.

The shaft is first roughed down on centers to a close fit in the offset fixtures; then it is placed in these fixtures and clamped fast by binding screws which close the split portions of the fixture onto the shaft and by setscrews which act against the web in the fixture on the live spindle. The shaft is thus positioned correctly for the desired throw of the pin and the latter is readily turned without trouble from spring and vibration.

Plain Lathe for Crankshafts

Another lathe arranged especially for larger crankshaft work is illustrated in Fig. 5. This tool is used for turning shafts up to 3⅛ in. diameter by 5-ft. long, for 40-horsepower engines, yet it has no back gears, and as it is never used for threading purposes all screw-cutting attachments and gearing is left off. It is therefore a simple turning lathe which is used very effectively for the class of operations indicated. In considering a lathe for the purpose, the Witte company found that it must have a swing of 36 in. At the same time it desired to use a high work-speed and a comparatively light cut, rather than a low speed with a heavy chip, for the reason that it would, by the former course, avoid the trouble due to the springing of the shaft, which would occur with the taking of deep cuts under coarse feeds.

A 36-in. standard lathe would, therefore, present possibilities in the way of heavy chip removal which it did not care to avail itself of, and, on the other hand, it would not give the desired high work-speed through the back gears without an abnormal pulley speed. The company therefore, determined to dispense with back gearing and secure the necessary

driving power by a wide belt on large pulleys mounted directly on the spindle.

Details of the Lathe

A good idea of the spindle drive is seen in Fig. 5. The lathe is a Le Blond 27-in. with headstock and tailstock of 36-in. swing. The back gears are removed and five plain pulleys ranging from 10 to 28 in. in diameter are carried on the spindle. As the pulleys receive a 5-in. belt there is ample power for taking the cuts required at the desired rates of speed. This drive gives a range of speeds from about 60 to 400 revolutions per minute.

Ordinarily the shafts are reduced about $\frac{1}{16}$ in. in diameter with the roughing cut and a feed of from $\frac{1}{16}$ to $\frac{1}{8}$ in. is employed. About $\frac{1}{64}$ in. is left for a finishing cut. The crank webs and pins are also turned on this lathe, and for holding the work for the pin turning a fixture is used which is something like that shown on the lathe in Fig. 4.

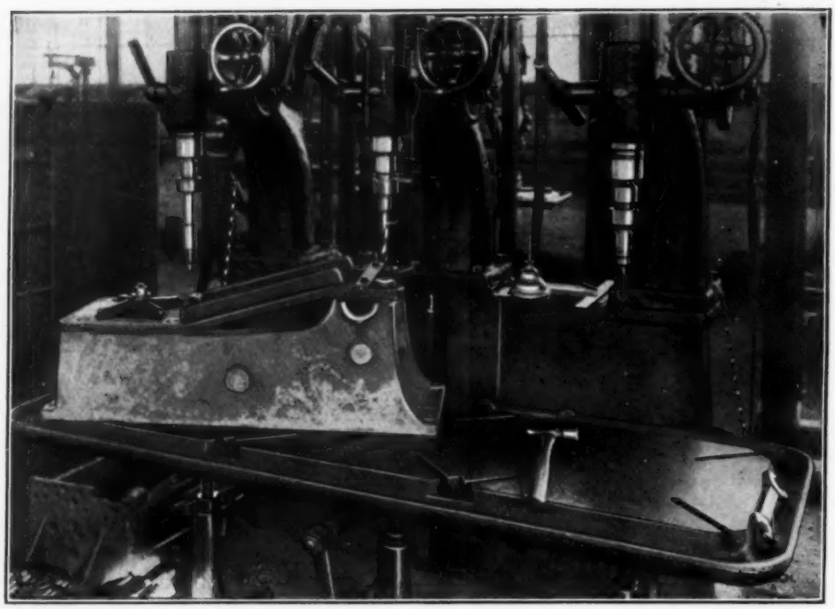


Fig. 2. Drill Jig for Gas-engine Base

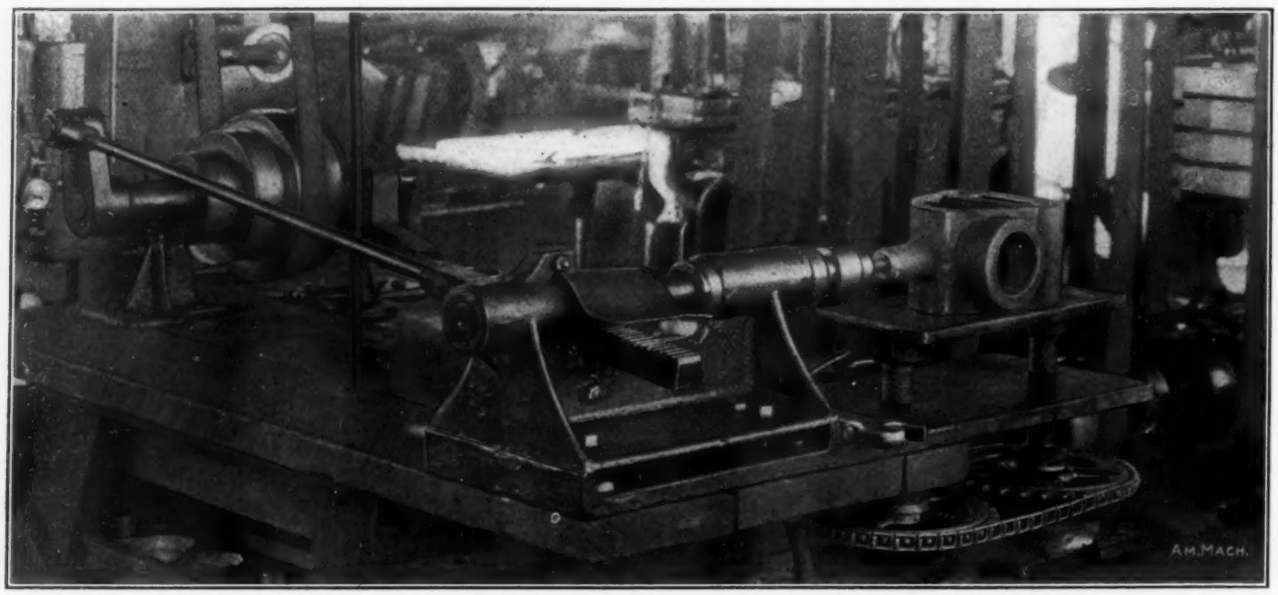


Fig. 3. Machine for Grinding-in Valves

Machining Flywheels

An American lathe with turret and cross-slide tools for machining flywheels is shown in Fig. 6. The method of holding the casting and the nature of the tools will be understood upon inspection of the halftone.

The first operation is the centering or truing up of the mouth of the cored hole with a flat spotting drill in the turret. A half-round drill is then run through the rough hole and this is followed by a double-end cutter in the boring bar shown in working position in the turret. The rim is rough turned by tools carried in a crosswise holder projecting from the inner face of the right-hand tool slide, and the sides of the rim are rough faced

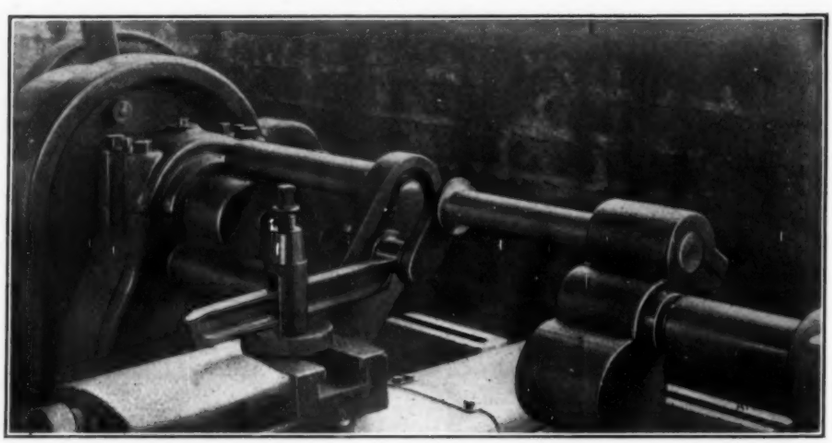


Fig. 4. Turning Crankpins

by straddle tools in a block on the cross-slide to the left.

The roughing of the hub is accomplished after the reaming of the bore, by means of a special form of hollow mill carried on the turret face and guided by a pilot fitting the bore. This tool is shown on the front face of the turret, and as will be seen, it has two inserted cutters for turning the outside of the hub and a flat cutter for facing the hub end.

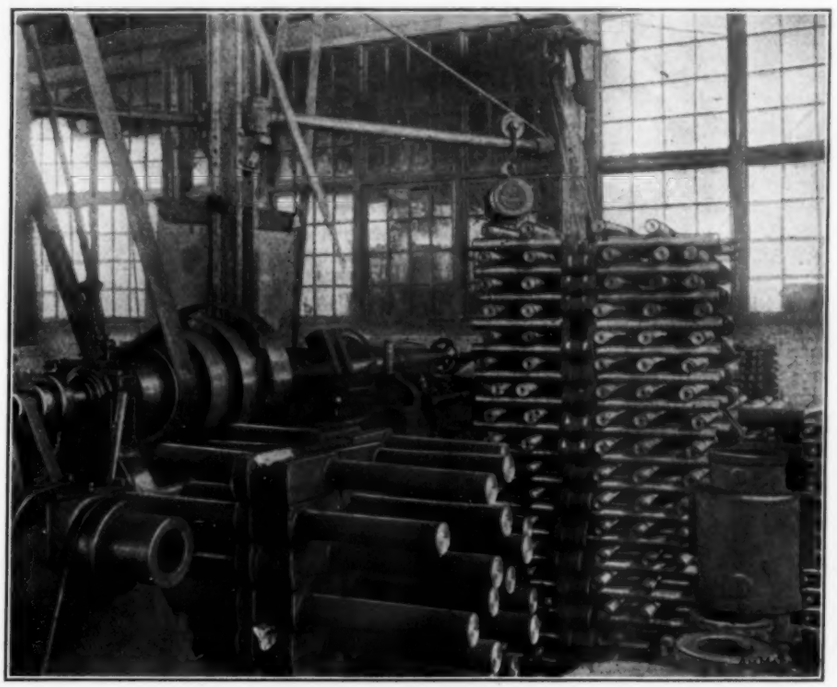


FIG. 5. LATHE WITH PLAIN HEAD FOR TURNING CRANKSHAFTS

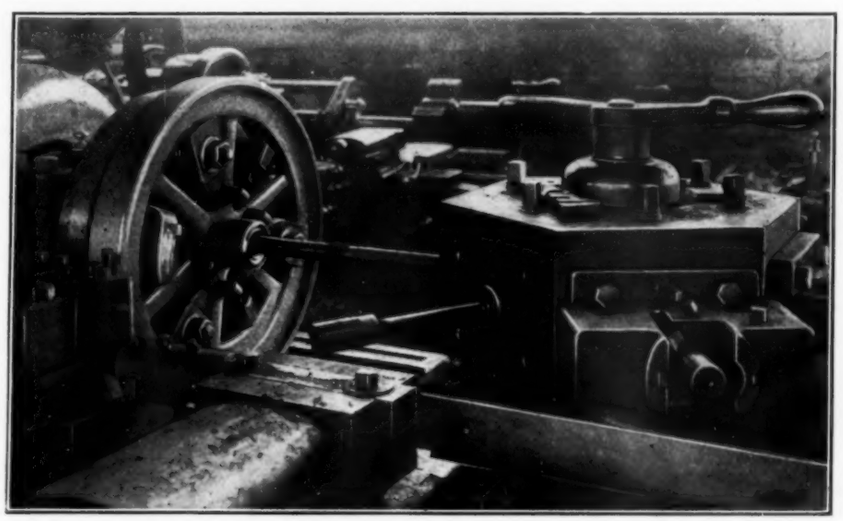


FIG. 6. PULLEY-MACHINING EQUIPMENT

The sides of the rim are finished by two cutters projecting from the crosswise holder carried by the right-hand cross-slide, and the hub is finished with a piloted turret tool similar to the one referred to above. The chamfering of the end of the hub and of the mouth of the bore is accomplished with tools carried in the same holder as the flat drill which is used at the outset for truing the mouth of the cored hole preparatory to the boring operations.

CYLINDER POLISHING MACHINE

A home-made machine is shown in Fig. 7. It is for rotating cylinders while the ends are being filed and polished. The apparatus consists of a gas-pipe frame with a belt pulley and a three-winged center at one side, with a similar center on a sliding shaft at the other side.

Between these large centers the cylinder is secured by means of the lever at the right which slides the tail center into the work. The three blades of the head center serve as a driver for the cylinder and the work is rotated by the belt pulley at a suitable rate of speed for the operation illustrated.

Capacity of the Prony Brake

BY F. A. HALSEY*

With a single exception, every attempt to determine a constant for the capacity of the Prony brake known to me has proceeded on the assumption that the limiting capacity is to be figured in the same manner as the power absorbed, the speed of the brake being included as a factor in this limiting capacity.

For example, in "Kent's Pocketbook," page 1281, of the new edition, W. W. Beaumont gives a formula for the design constant, in which the velocity is a factor; and Prof. Flather, in a series of articles appearing in the AMERICAN MACHINIST some years ago, adopted the same basic assumption.

In Vol. 28, Part 2, page 127, I gave the dimensions of a brake at the works of the Union Gas Engine Co., of San Francisco, which had been found capable of absorbing continuously 140 hp., but which took fire when loaded with 150 hp., and this being a clear case of a brake worked to the limit of its capacity, I figured out and published the design constant on the usual assumption that the speed of the brake was a factor in its capacity.

E. H. Waring fired back, in Vol. 28, Part 2, page 740, and pointed out that the velocity had nothing to do with the capacity, which is simply a matter of the capacity of the water to absorb heat, this in turn being measured by the drum surface alone. A little reflection convinced me that Mr. Waring was right, and some new data from E. J. Armstrong, chief engineer of the Ball Engine Co., have so confirmed the results obtained from the Union Gas Engine Co.'s brake that the matter is worth noting.

In this connection it should be said that the attempt to deduce constants from the old assumption has led to figures which are wild in their discrepancies, which is what must be expected when results are based on an analysis which contains a factor having nothing to do with the constant sought.

The Union Gas Engine Co.'s brake had a drum 30 in. in diameter by 20-in. face, and this was found capable of absorbing continuously 140 hp. at 350 r.p.m., while under continuous work it took fire when loaded with 150 hp. Mr. Armstrong's brake has a drum 48 in. in diameter by 16-in. face, and absorbs 200 hp. "without very much trouble from the blocks catching fire. At 225 hp. it takes fire every minute or two, and 260 hp. is the ab-

*Editor Emeritus.

solute limit with one man handling a garden hose and devoting himself to putting out the fires." The blocks are kept well greased with tallow. Both brakes are of Prof. Sweet's pattern with water cooling and both are fitted with maple blocks.

With Mr. Armstrong's brake 200 hp. are obviously about equivalent (perhaps a little more than equivalent) to 150 hp. with the Union Gas Engine Co.'s brake. The Armstrong brake has a total drum surface of

$$\frac{18 \times 16 \times 3.1416}{144} = 16.755 \text{ sq.ft.}$$

which, divided by 200, gives 0.0838 sq.ft. per hp. Similarly the Union Gas Engine Co.'s brake has a drum surface of

$$\frac{30 \times 20 \times 3.1416}{144} = 13.08 \text{ sq.ft.}$$

which, divided by 150, gives 0.0872 sq.ft. per hp. From these data we may fairly conclude that 0.09 sq.ft. per hp. marks the limit where firing is imminent, and this value is further fortified by Mr. Waring's value of 0.1.

FIG. 7. A CYLINDER POLISHER

INFLUENCE OF THICKNESS OF DRUM AND BLOCK SURFACE

Mr. Armstrong points out that the thickness of the drum must exert an influence on the capacity. His drum is ¾ in. thick—that of the Union Gas Engine Co.'s brake being unknown. He also considers that the amount of block surface exerts an influence. His brake has twenty-five 3x16-in. blocks, covering almost exactly half the circumference. This figure for the Union Gas Engine Co.'s brake is also unknown. The concordance of the figures, however, is a clear index of their reliability.

The agreement of the figures is certainly striking, and goes far to confirm the soundness of the viewpoint, if that were needed, which, indeed, it is not. Readers of the AMERICAN MACHINIST having additional definite data are solicited to contribute them for purposes of confirmation or amendment to the conclusion here given. Even without these, however, it would appear that we have two absolutely independent data from widely separated sources, which confirm one another so strongly as to make them worthy of confidence and adoption, even in the absence of additional figures.

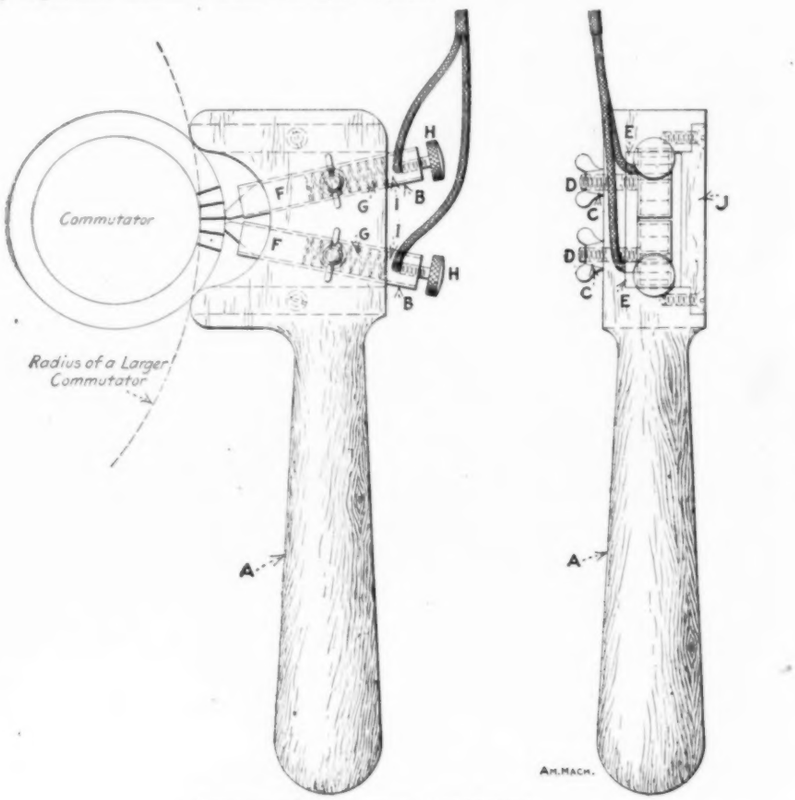
Commutator Testing Apparatus

BY JOHN UNGER

The body and handle of the apparatus, made of fiber or hard wood, are shown at *A*. *B* and B_1 are rectangular brass tubes, 20 gage, with the brass plates *E* and E_1 about ⅛ in. thick, soldered on the side to strengthen and give more section for receiving screws *D* and D_1, which are threaded and soldered in the plates. *C* and C_1 are thumb-nuts for clamping brass tubes *B* and B_1 against the side of the body when adjusting them for different size segments. *F* and F_1 are the steel contact pointers which are pushed against the segments by means of springs *G* and G_1.

The knurled screws *H* and H_1 connect the flexible wires to the spring-holders *I* and I_1. The fiber cover *J* acts as insulation for the tubes *B* and B_1. The other ends of the flexible wires are, of course, connected to the test lamps.

A small turntable should be made in connection with this apparatus, for revolving the commutators when testing, as it will greatly improve the operation. By means of this apparatus 100 commutators can be tested in 10 to 15 minutes, where three to four hours were required in the old way. Furthermore, the danger of holding live wires is also diminished.



COMMUTATOR-TESTING APPARATUS

Milling Operations on the Planer

By Glenn Muffly

Applications of the milling attachment to such work as the boring and facing of the milling heads themselves, the hobbing of wormwheels, the milling of sprockets and the facing of a variety of castings, including cylinders for aeromotors.

It is not always that a tool suited for a wide range of work can be used to the best advantage in manufacturing.

The illustrations herewith show how the Adams Co., Dubuque, Iowa, has adapted an all-around tool to special jobs by the addition of the Farwell milling head. It is believed in this case that the adaptability of the machine to special conditions makes it practically a special machine designed for the job it is used on. Another interesting feature is that Figs. 1, 2 and 3 show the milling heads used in their own manufacture.

Boring and Facing

The boring and facing operation on the swivel side of the milling-head housing, which bolts to a circular T-slot in the special saddle upon the planer rail, is seen in Fig. 1. The tool used for this operation is carried by a traversing head with a star wheel to control the radial feed. A horizontal boring operation on the same planer is shown in Fig. 2. The large casting upon the planer table is a No. 3 milling-head housing. The milling-head saddle is connected with an extra screw in the planer rail to provide a cross-feed, which is used in boring operations of this sort.

A Hobbing Operation

A wormwheel hobbing operation on a planer may seem rather unusual, but Fig. 3 shows how it is handled with the aid of a special fixture and a milling head. This photograph, by the way, shows the same planer and milling head as Figs. 1 and 2. The feed is accomplished by moving the table of the planer. The feed mechanism employed for this consists of a variable-speed friction drive to a split wormwheel, which is clamped upon the

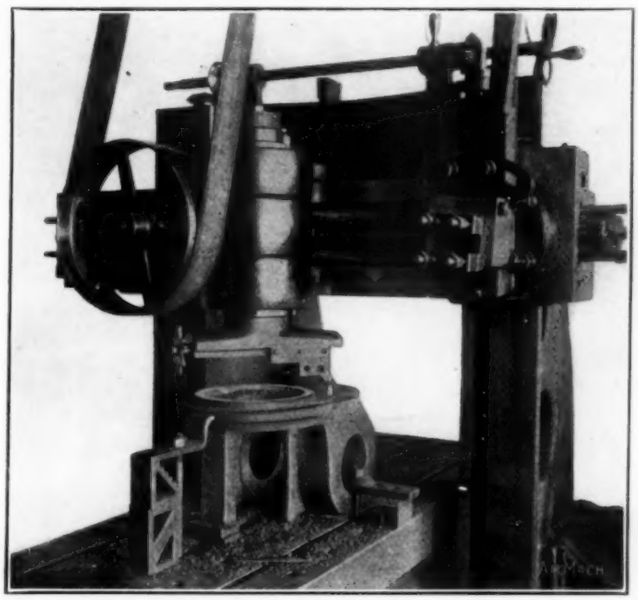


Fig. 1. Boring and Facing Milling Head on the Planer

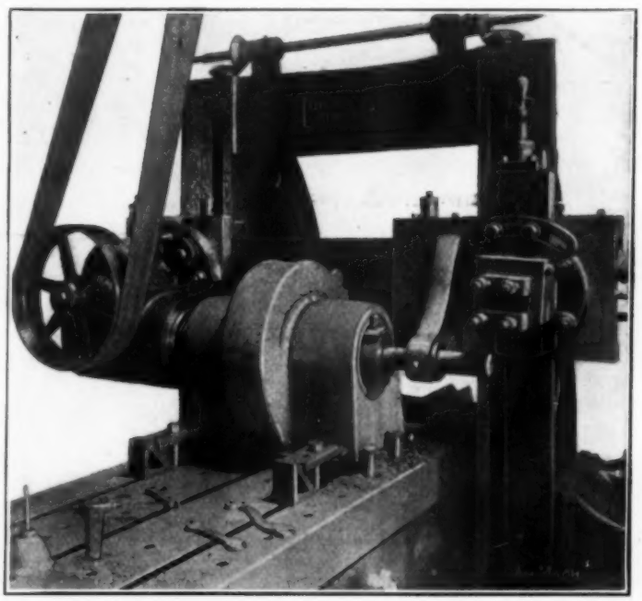


Fig. 2. Boring a Milling-head Housing on the Planer

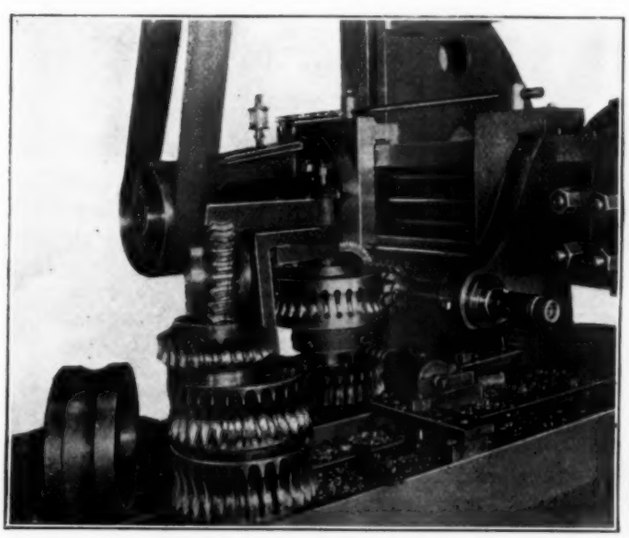


Fig. 3. A Hobbing Operation on the Planer

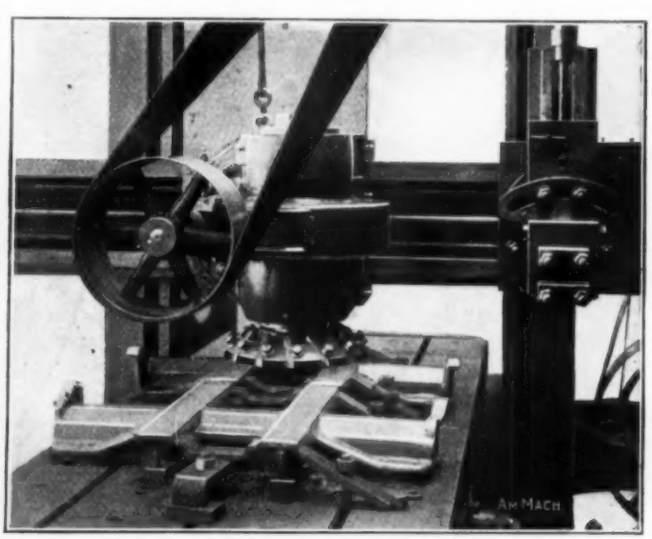


Fig. 4. Machining Squeezer Tables

regular planer countershaft. The friction drive affords a wide range of feeds in either direction, and a shift lever disengages this feed mechanism from the wormwheel by raising the worm out of mesh with the wheel.

Since the milling feed is secured through the regular planer-drive mechanism, nothing is disturbed and it is possible to change instantly from the milling feed to the planer drive. This is sometimes done to return the table quickly after a milling cut is finished.

Rotary Planing and Sprocket Milling

A 36-in. planer, used in the same shop for rotary planing on squeezer tables, is shown in Fig. 4. The cutter is an 18-in. inserted-tooth face mill, with considerable rake to the teeth. This is another case in which the milling feed is used on the planer table. The casting in process of boring, in Fig. 2, is the housing for a milling head of the same size as the one used in Fig. 4. A vertical adjustment, independent of the planer rail, is sometimes required, in which case a double saddle is used, as shown in Fig. 4.

Spur gears might be cut with one of these milling attachments in the same way as on a plain miller, but, of course, this cannot be considered a manufacturing proposition. Fig. 5 shows a sprocket-cutting operation, which would ordinarily require a very heavy gear cutter, but which is handled nicely on a planer, and, except for the fact that it is not an automatic machine, the time is satisfactory.

Angular Milling Operations

The job shown in Fig. 6 is, however, one for which a planer and milling attachment makes an ideal special machine. A jig holding two gas-engine cylinders is arranged to pivot so that one may be changed while the other is being milled. These cylinders belong to a five-cylinder revolving aëromotor, and the base angle is, therefore, 72 deg. By using two milling heads swiveled to 36 deg. from the horizontal, the planer is converted into a special miller equal to a machine designed and built for this one job. As the spindles of the milling heads take an arbor in either end, it is possible to keep the worm drive of both in position to receive oil from the drip cup provided for lubrication. This also makes it possible to set two heads with spindles very close together in a vertical position.

An operation similar to that in Fig. 6 is shown by Fig. 7, where a single milling head is used to finish one angle of the cylinder base at a time. The circular table carrying the work is revolved by means of a worm gear to secure the correct angle between the two surfaces to be milled in this way. This same revolving table is also used in wormwheel cutting and special circular milling operations.

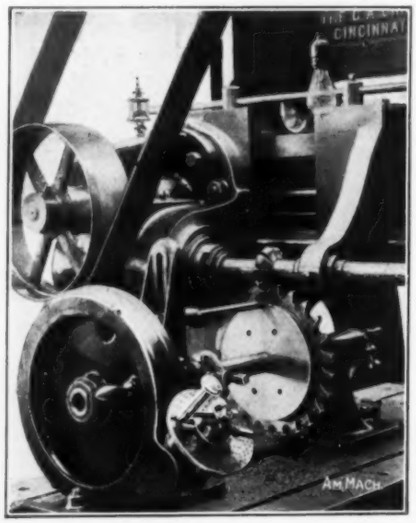


Fig. 5. Cutting Sprockets

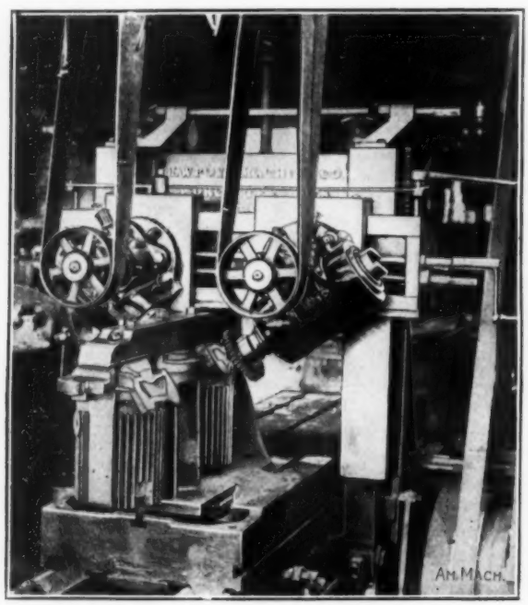


Fig. 6. Milling Gas-engine Cylinder Bases on the Converted Planer

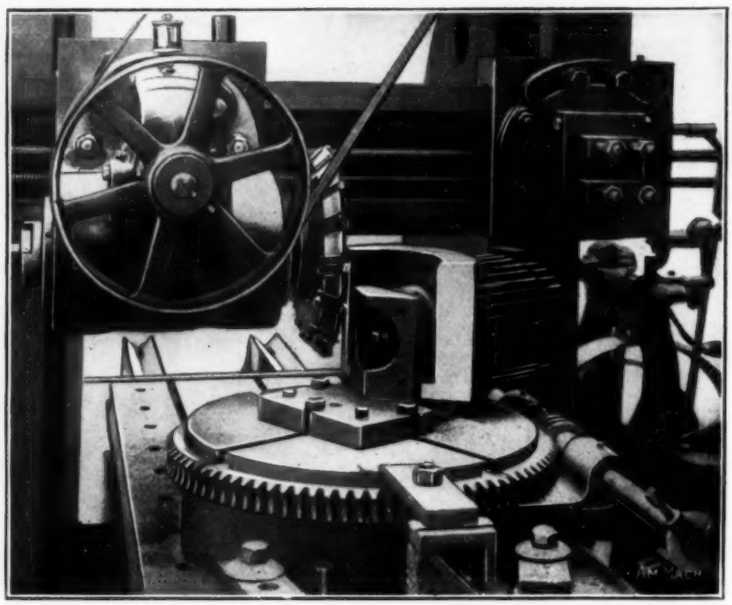


Fig. 7. An Angular Milling Job on an Indexing Table Done on the Converted Planer

Co-operative Continuation School at Hartford

On Mar. 18, a coöperative continuation course was opened in connection with the Hartford, Conn., high school. Some 70 boys were enrolled.

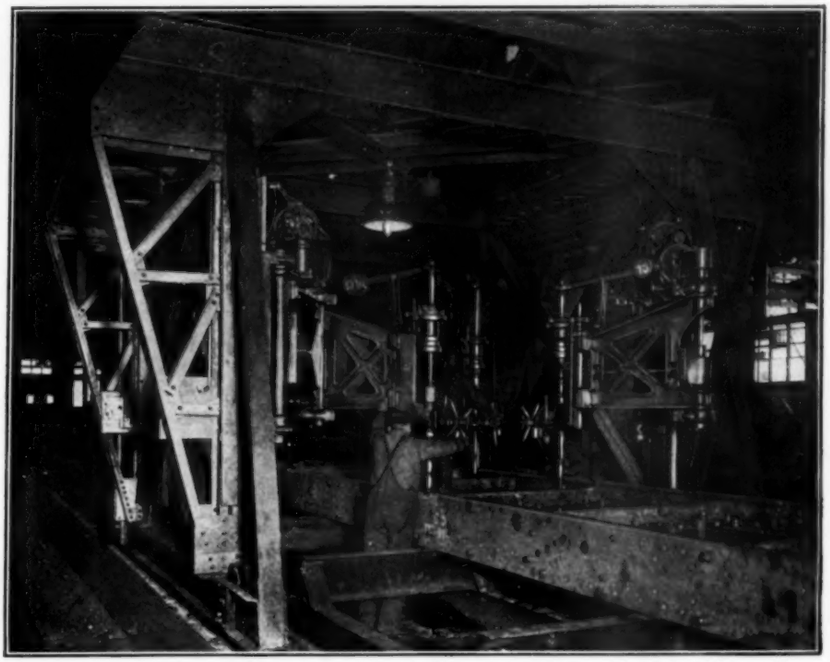
This is the outgrowth of a movement started by a committee of the Manufacturers' Association of Hartford County, working with the local high-school authorities. The plan adopted was modeled from the coöperative half-time courses of Cincinnati, and the so called Fitchburg plan.

The boys are to receive their shop experience in the shops as well as a knowledge of the theory of shop practice through explanations by men in the shop where by previous arrangement, the classes will be taken. This latter will especially cover machines for rapid production, as turret lathes, screw machines, punch presses, and the like. The important features of these visits will be discussed later in the class room.

The course is to extend over a period of four years. The class-room instruction will cover English, drawing, mathematics, science, accounting and system, civics and economics, industrial history and geography, and the theory of shop practice.

Large Reaming Machine

The McClintic-Marshall Construction Co., Pittsburg, Penn., employs the quadruple reamer, shown in the accompanying illustration, in its shops for reaming holes in the steel girders used for Panama lock gates.



QUADRUPLE REAMER, REAMING PANAMA LOCK GATES

The machines consist of a huge structural-steel housing in the form of a gantry, on the inside of which four driller heads of the wall radial type are placed so as to be easily manipulated for reaming purposes.

Each head is driven by an individual motor, and a flaming arc lamp set above the machine furnishes light for the workmen. A separate motor is also used to run the gantry along the track when necessary.

Parting Die for Automobile Headlight Tops

BY ARON LAWRENCE

When drawing parts from sheet metal similar to the piece illustrated in Fig. 1, which represents the head or cap as it is sometimes called, of an automobile head lamp, it is often found desirable to draw them in pairs in order to balance the strains in the metal to prevent wrinkling and also for reasons of economy.

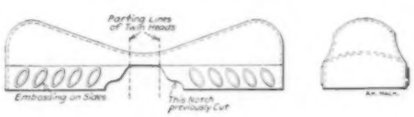


FIG. 1. FORM OF CAPS BEFORE PARTING

In the case under consideration, this was the method adopted, and the various operations of trimming, embossing and notching of the piece shown in Fig. 1 are all performed before parting or separating the two heads.

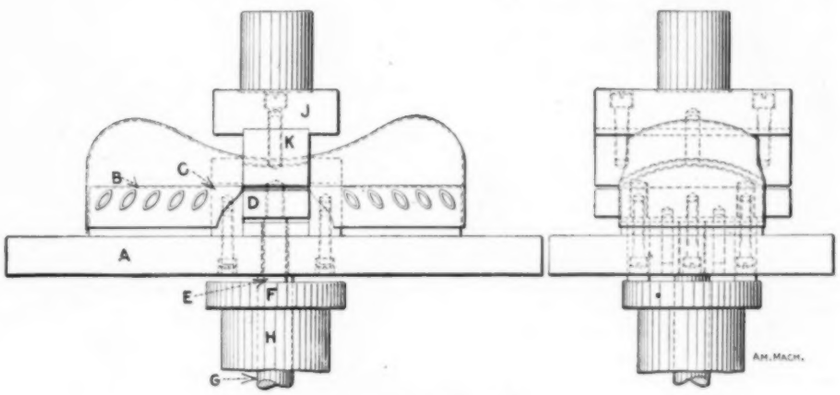


FIG. 2. THE PARTING DIE

The die for parting is shown in Fig. 2, *A* representing a cast-iron shoe integral with two rectangular bosses shown at *B*. The central part of this casting is machined out for the accommodation of the parting die pieces *C* which are of hardened tool steel and secured to *A* by fillister-head screws and dowels. Sliding between these pieces is a stripper block *D* of soft steel, which is carried on the upper extremities of two steel studs *E* which slide in suitable holes in the base *A* and whose lower extremities rest upon the pressure plate *F*. A steel bumper stud *G* is screwed into the lower central portion of *A* and carries the rubber bumper *H*, which serves to actuate the block *D* through the pins *E*. A punch holder *J* of cast iron, provided with a stem for attachment to the press ram, carries the parting punch *K* of hardened tool steel, which is secured to its lower surface by fillister-head screws and dowel pins. The upper parts of the blocks *C* and the lower part of the punch *K* are shaped to conform to the irregular-curved surface of the part being operated on.

The twin heads are located over the rectangular bosses on *A* from which they are readily removed after parting, and the scrap is merely knocked out of the die before placing a new part in position.

This die shows that irregular curved surfaces may be operated upon successfully with press tools if properly designed, although sometimes the subsequent sharpening of the die and punch prove difficult to provide for. In this particular case a simple attachment for the grinder enables the die and punch to be ground without destroying the contour of their surfaces.

Length and Diameter of Spring Wanted

BY P. STEINER

I submit the following problem to readers of the AMERICAN MACHINIST. A flat coil spring ½ in. thick is fastened to a 1¼ shank or arbor while the other end is fastened inside the spring case which surrounds the spring and arbor. The arbor is required to make 3½ turns and then the spring is wound tight on the arbor.

What is the length of the spring required and the smallest possible inside diameter of the spring case?

The value added by manufacture in the industries of the United States was $8,530,761,000 in 1909 and $6,293,695,000 in 1904, an increase of $2,237,066,000, or 36 per cent. This item formed 41 per cent. of the total value of products in 1909 and 43 per cent. in 1904

Gas Engine Cam Design

By C. M. Mohler*

A sustained criticism of the existing type of cam and advocacy of a new and comparatively noiseless type. The author defends gas engine "wire drawing" and enumerates some of its advantages.

*Superintendent, American Motors Co., Indianapolis, Ind.

Mr. Niven's article, "The Design of Automobile Cams," in Vol. 35, page 1018, is a clear demonstration of what one must contend with in laying out this common type of cam. But why this type of cam? Is there not a better type? Does the precedent of years prove all its practices right?

There are several reasons why this cam with its attendant mathematics should be retired for a type practically free from so much figuring.

It is a type that cannot impart quiet motion to the valve and other actuating parts, with a clearance within a practical working amount. To have any resemblance of quiet the clearance must be well within 0.005 in. This is too small to insure perfect seating of the valves for a satisfactory length of time under changing atmosphere conditions and wear. Furthermore this cam is too sensitive to slight variations of timing. It is also too sensitive to slight variations in workmanship. Inertias of its actuated parts at the opening and closing points are unnecessarily high as compared with the type of cam hereinafter presented. A final but important criticism lies in the fact that the automatic opening of the valves imparted by this cam is too quick for an ideal adjustment of the cycle.

Type of Cam Advocated

The cam advocated is shown in Fig. 1. In this the base and zero circles become the foundation upon which the cam is designed as follows: Angle ø is laid off and lines *OA* and *OH* are drawn. At the point of intersection of these lines with the zero circle, are the opening and closing points. Lines *JK* and *MN* form the sides of the cam and are tangent to the zero circle at the opening and closing points, therefore *tt* is always 90°.

The maximum lift is represented at *l*. The cam point arc described by the radius *r* passes through the maximum lift point and tangents the sides of the cam or lines *JK* and *MN*. *BB* are the angles of position. These angles are always 10° and are for the purpose of bringing the valve pushers and the valve stems together without noise. *ee* are the approach angles, called so, because within these angles are the arcs that move the pushers to or from the opening or closing points to or from the arc of rest within angle *g*. This angle *g* is invariably but not necessarily 90°.

Among automobile engineers and shop men, who have the building and testing of engines, the opinion prevails that the timing of a gas engine must be very exact. Mr. Niven's statement that the timing of a gas engine need not be extremely accurate is absolutely right. The timing as given by the engineering department is presumed to be approximately correct.

The correct setting of gas-engine valves can only be obtained by the use of the indicator. Frequently no two cylinders of a two-or-more-cylindered engine will call for the same settings. This is due to the size, shape, length and surface condition of inlet and exhaust piping; to the shapes and lifts of cams, to the size and shape of valve ports, and to the carburetor and muffler.

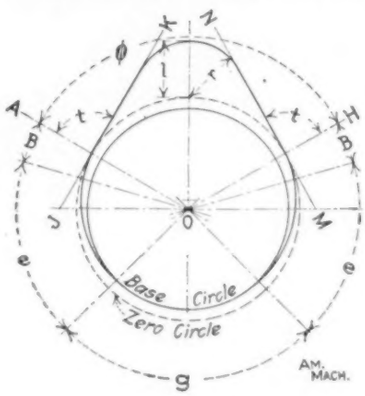


Fig. 1. Cam Advocated

Wire Drawing

Surely all who make it a practice to read articles on gas-engine designing have at some time read the pros, and cons of quick-opening valves. Quick opening of gas-engine valves is not of any real value; it can easily be, and often is, opposed to real economy. The important thing in gas-engine valve timing is to get all of the products of combustion out and new mixture into the cylinder at atmospheric pressure. "Wire drawing" will aid in doing this. There is not the direct heat loss due to "wire drawing" in the gas engine that there is in the steam engine.

There has been no heat generated in the power fluid previous to introduction into the cylinder as is the case in the steam engine. An endeavor will be made to show that "wire drawing" is one of the means of securing conditions that are ideal in the gas engine.

Wherein the Recommended Cam Differs

The cam design shown in Fig. 1 is perhaps new to many. It is a development of the Atkinson scavenging cams used by Crossley Bros. Ltd., of Manchester, England. This cam differs from the type shown in Mr. Niven's article in that the straight sides of the cam are tangent to the zero circle instead of to the base circle, and therefore the opening and closing points are true tangent points.

Position arcs of 10° length are provided and within which the pushers approach the valve stems very slowly, the takeup not exceeding 0.0015 in. This is for the purpose of securing quiet without the extremely small clearance that must prevail in the type shown by Mr. Niven. With the cam shown in Fig. 1 the clearance may be almost any amount the designer wants, without in the least affecting the quietness of operation. As much as 0.080 in. has been used with absolutely quiet operation.

With this new type of cam, all the calculation described by Mr. Niven is avoided. The cam roller may be any diameter. The base circle of the cam may be any size without affecting the timing. Only the mathematics required to reduce correctly the angles of opening and closing (the active angles of the cam) is necessary.

Recapitulation

The straight surface or sides of the cam being tangent to the zero circle gives a creepier or a slower opening and closing of the valve than is the case with the cam having the sides tangent to the base circle. To equalize, the timing of the slow cam must be earlier for the opening and later for the closing. The slow cam causes the "wire drawing" so much tabooed by some writers, but actual tests have proved it to be of decided advantage for the following reasons:

The slower opening compels the exhaust to begin more gradually. The column of gases in the exhaust pipes is set in motion as a long puff and not a sharp crack or explosive. The earlier opening introduces a time element whereby the velocity of the gases in the exhaust pipes can be brought much higher, at the time the piston begins the exhaust stroke, than is possible with the quicker opening but later timed cam; therefore the slow and earlier timed cam allows the use of a less restricted muffler which lowers the back pressure for all conditions of rotative speed and volumes required in autimobile work.

The problem is better solved in this manner by the use of the slow and wider

cam (the earlier opening and later closing gives the wider cam) the velocity curve of the exhaust gases will go higher and the peak of the curve will be much longer in duration, other conditions being equal. Here it is well to state that in moving a mobile body such as liquids or gases by an intermittent force, such as the exhaust of a gas engine, the movement is decidedly wavelike in character, hence the term "exhaust wave."

In circulating the gases, or power fluid, to and from the gas engine, the best conditions are secured by a careful study of the exhaust wave as shown by the indicator. This can be accurately adjusted by varying the magnitude of the "wire drawing," the timing of the valves and the length and area of the exhaust

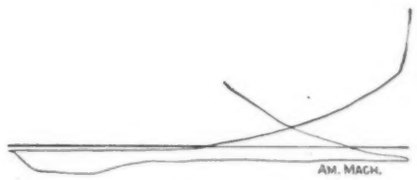


FIG. 2. SHOWING A GOOD EXHAUST

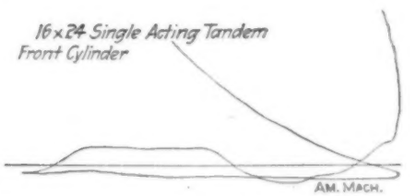


FIG. 3. CONDITIONS WITH COMMON CAM AND LONG EXHAUST

piping. Care should also be taken not to forget the muffler.

A fairly good illustration of what can be accomplished along these lines is shown in Fig. 2. An illustration of an average condition with the common type of cam in connection with a long and large area exhaust pipe is shown in Fig. 3. Fig. 2 shows a much better exhaust. If the admission of fuel and air is controlled by two separate valves, the air valve can be opened about 80° early and perfect scavenging results.

Nothing has been said regarding the induction side of the gas engine. In automobile gas engines, of equal importance with efficiency, is quietness of operation. In this respect there is no comparison between the two types of cams. The new type can and is being commercially made absolutely quiet.

The position arcs provide in a much better way what is sought by the designer of the common type of cam in reducing the clearance to 0.005 in. (hunting the tangent point) and has the advantage of a much greater clearance during one full revolution of the crankshaft in each cycle.

In heavy gas engines in which inertias of the valve and linkage become a serious consideration, this new type of cam meets the situation in the best possible manner. Many think the valve action will be quieter as the clearance is reduced. This is true of the common type of cam.

With the type of cam here shown the clearance can as easily be too little as too great. It has been found advisable to reduce the clearance to 0.035 in. for no other reason than that a greater clearance will give the garage mechanic an opportunity to display his knowledge of gas-engine science, with annoying results to both the owner and manufacturer of the car.

An Articulated Locomotive of 1857

EDITORIAL CORRESPONDENCE

In these days of increasingly heavy motive power we have perhaps not been duly impressed with the large Mallet and other articulated locomotives, including those of the Santa Fé road, which weigh 850,000 lb. each.

The latest development along this line is seen in a recent patent granted to Geo. R. Henderson, of the Baldwin Locomotive Works, which, in addition to having two sets of driving wheels under the engine proper, also has a power unit under the tender.

It so happens that at about the time this was issued, one of our friends sent us a catalog issued by A. B. & E Latta, builders of steam fire engines, tubular boilers, steam pumps, stationary engines, etc., in what was known as the Buckeye Works, Cincinnati, Ohio. This catalog bears the date 1857 and contains, among other interesting machines, the locomotive illustrated herewith.

Forgetting, for the time being, all about the improved spark arrester and other fancy details, such as the inclosed engine and boiler, we see at once a remarkable similiarity between this engine and the one covered by the recently issued patent, inasmuch as there is a complete power unit shown under the tender.

The object as set forth in the catalog was to divide the weight up among a larger number of driving wheels so as to be easier on the track for the same weight of engine. It was estimated that while this arrangement would, on a 25-ton engine, cost from $2000 to $3000 more than the regular type, there would be 75 per cent. less wear on the roadbed and it would be generally advantageous.

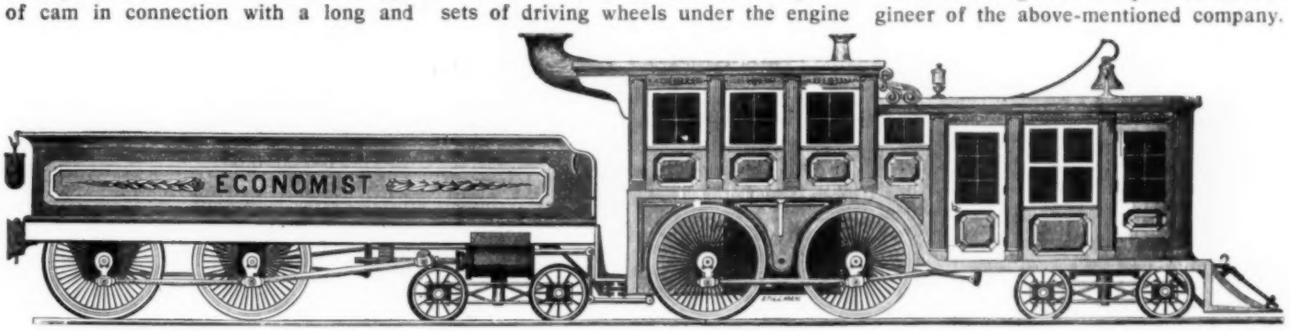
The steam was to be carried back to the rear engine by a ball-joint pipe and the exhaust brought back in the same way, all cylinders being, of course, controlled by one throttle valve.

The catalog also contains an excellent argument against the increase of weight in locomotives, and contends that weight and not speed wears the track. As proof of this, the reader is invited to examine the track, leading from the engine house to the station. Cars never run here and the engines run but slowly, yet the wear is said to be heavier than at any other part of the road.

It also notes that all who have observed early railroading, remember well how engines weighing 10 to 12 tons were run with very much less wear and tear than those which we now have. The reason given is that the weight was light as compared with the "monsters" which were being employed at the time this was written. 1857.

The rest of the catalog is devoted to other locomotive details and shows considerable thought on the part of the engineer of the above-mentioned company. It also shows very clearly that at all stages of mechanical development in this country there have been men prolific in ideas, many of which were too far in advance of their day to be used during their lifetime.

We are indebted to Samuel H. Ralston, Norristown, Penn., for the illustration and for the privilege of examining these catalogs.



AN ARTICULATED LOCOMOTIVE DESIGNED IN 1857

Analysis Variations in Steel

By E. F. Davis*

Some chemical analyses of steel shipped on specification that developed strange variations in quality and proved the shipment, in part, quite below the standards called for. The importance of determining these variations before machining is made apparent by the author, who also points out the futility of iron-clad specifications that are not supplemented by analysis when the steel is received.

*Chief chemist, Warner Gear Co., Muncie, Ind.

Of all the raw material sold to the factory, there is none as extensively used or subject to as much variation as steel. In some plants large varieties and grades of steel comprise the different parts of the plant production. The automobile is an example of this, wherein every kind of steel, from the most expensive alloy steels to the cheapest carbon stock, is made use of.

The heat treatment on all these different steels is peculiar to each grade. Chrome vanadium cannot be hardened at the same temperature as 3½ per cent. nickel steel, neither can the same heat treatment be accorded both. It is necessary that the hardener should know exactly what material he is working; the unknown substitution of one steel for another generally causes a failure of the part in service.

Effect of Substitution on Construction

If this substitution were not common, there would be no purpose in contributing on this subject. Every manufacturer is familiar with the complaints received as a result of such substitution, a fact which emphasizes the necessity of an exact knowledge of the bar stock, forging, casting or any raw material entering into the product of a factory. Breakages are also due, of course, to accidents and faulty design, or improper selection of construction materials; these conditions, however, are irrelevant and will receive no consideration in this article.

In these days of scientific management, we hear and read much of economic shop methods, especially in reference to increasing the efficiency of labor, but are told very little about correcting the evils of adulterated shop supplies, nostrums and inferior raw materials.

In the handling of bar stock by concerns using many grades of steel, it may be assumed that all the proper precautions are used for separating each kind of carbon steel, the nickel from the vanadium, etc., by special and distinctive colors of paint, by individual stamping of bars, or by some other equally satisfactory means of identification. With the exception of an occasional analysis by a commercial laboratory, many believe this to be sufficient and pay no further attention to the steel. However, when parts are returned fractured or defective, the hardener is called upon to explain. In all probability the real fault lies not with him but with that bar of bessemer stock in some particular shipment of nickel steel, or in some other equally disastrous combination.

With our present knowledge of case hardening and heat treatments, recalescence and decalescence, and the modern equipments of pyrometers, testing apparatus, lead baths and excellent forms of furnaces, it is hard to believe that half the failures attributed to faulty hardening are due to ignorance or carelessness, but rather to the unknown mixture of improper steels or a lack of uniformity in the bars or forgings from which the parts were made.

It is an indisputable fact that a variation of only one-tenth of one per cent. of the carbon content of this metal changes to a remarkable degree its ultimate strength and other statical properties, and also its sensitiveness to heat treatments. Wide variations in other elements, such as manganese, have effects on the strength, toughness and endurance, but not to so marked a degree. Far more weakness, brittleness and fractures occur because of inattention to this important subject than because of inferior case-hardening, materials, methods, carelessness in hardening, or the many other common causes assigned for defective work. You cannot expect uniform results without uniform steel.

Rejections of Faulty Steel

After reviewing the rejections of steel during 1911 by a certain plant laboratory, accepted here as a standard for illustrative purposes, and reflecting on the fact that its orders were given to almost all the leading steel companies, and at times when necessity demanded it, to several jobbers in bar stock, the conclusion was reached that this concern was fittingly representative of others, and that all factories knowingly or unknowingly have the same evils to contend with in the purchase of bar stock.

In the laboratory in question, it has been the practice to keep the most exact check on all receipts of materials, to the extent that every bar of steel is analyzed and must receive the laboratory's O. K. before any machining operation is allowed. A few analyses of rejected shipments contain surprising information to many, as they show only too fully the folly of careless acceptance of raw material, at least in the nature of bar stock and forgings.

Eleven bars of nickel steel were received from a large steel mill making a specialty of alloy steels. This steel was to be used on differential inside pinions, to be case-hardened and heat-treated to obtain a hard wearing surface, ranging from 75 to 85 scleroscope hardness, and a tough core to withstand the shocks to which it was subjected. The steel ordered was to conform to the following specifications:

SPECIFICATION D

Sulphur	Not over 0.04
Phosphorus	Not over 0.04
Manganese	0.50 to 0.80
Carbon	0.20 to 0.30
Nickel	3.30 to 3.60
Silicon	Not over 0.20

This steel analyzed as follows:

	Carbon	Sulphur	Phosphorus	Manganese	Nickel	Analysis
Bar 1	0.40	0.022	0.014	0.795	3.17	2274
Bar 2	0.40	0.022	0.014	0.813	3.17	2275
Bar 3	0.26	0.031	0.015	0.614	3.47	2276
Bar 4	0.40	0.024	0.015	0.781	3.18	2277
Bar 5	0.40	0.022	0.014	0.813	3.17	2278
Bar 6	0.26	0.03	0.015	0.607	3.46	2279
Bar 7	0.26	0.029	0.014	0.589	2.94	2280
Bar 8	0.26	0.034	0.014	0.618	3.48	2281
Bar 9	0.40	0.022	0.014	0.817	3.18	2282
Bar 10	0.40	0.022	0.013	0.817	3.25	2283
Bar 11	0.40	0.024	0.015	0.817	3.17	2284

Enough steel to have made 350 of these pinions was thereby rejected. When it is considered that one broken pinion in a differential usually ruins the remaining gears by entanglement of the broken pieces in the meshes of the teeth, the result of sending differentials equipped with 0.40 carbon steel treated as 0.25 carbon may well be imagined.

As a second illustration, the analysis of 14 bars of medium carbon steel, purchased from a jobbing house, are given. These were to be used for transmission driving gears, requiring carbonizing and heat treatments. Enough of this steel was purchased to have made 125 of these gears. This bar stock was ordered to conform to the following specification:

SPECIFICATION F

Carbon	0.25 to 0.35
Phosphorus	Not over 0.04
Sulphur	Not over 0.04
Manganese	0.50 to 0.80

This steel analyzed as follows:

	Carbon	Sulphur	Phosphorus	Manganese	Analysis
Bar 1	0.36	0.073	0.106	0.807	2669
Bar 2	0.11	0.092	0.115	0.518	2670
Bar 3	0.35	0.052	0.091	0.921	2671
Bar 4	0.36	0.063	0.107	0.864	2672
Bar 5	0.33	0.056	0.095	0.778	2673
Bar 6	0.11	0.083	0.103	0.521	2674
Bar 7	0.33	0.053	0.09	0.968	2675
Bar 8	0.46	0.066	0.114	0.81	2676
Bar 9	0.38	0.067	0.113	0.807	2677
Bar 10	0.36	0.061	0.101	0.789	2678
Bar 11	0.49	0.076	0.129	0.871	2679
Bar 12	0.36	0.052	0.094	0.953	2680
Bar 13	0.37	0.069	0.115	0.678	2681
Bar 14	0.46	0.085	0.166	0.735	2682

The jobbers had sent this from their warerooms, supposing, no doubt, that the material was correct. These 125 gears would have been placed in 125 transmissions, or 125 automobiles might have been equipped with this faulty steel had not the proper precautions been observed by these previous tests.

Another example may be given of steel purchased from a third company. This was ordered to conform to the following specifications:

SPECIFICATION A

Sulphur	Not over 0.04
Phosphorus	Not over 0.04
Manganese	0.50 to 0.70
Carbon	0.40 to 0.50

This material was to be used for shafts, requiring a high elastic limit, combined with toughness, and were not, therefore, to be hardened. On receipt of the 21 bars comprising the shipment, analysis was made of each, and the carbon was found to range from 0.23 to 0.34. One bar also proved to be nickel steel of the following composition:

Sulphur	0.026
Phosphorus	0.02
Manganese	0.694
Carbon	0.23
Nickel	3.55

Variations in Steel Forgings

Forgings are not so easy to handle carefully as bar stock, as the analysis of every forging is an impractical proposition for many reasons. At the same time these are subject to as much variation as bar stock. Forgings received from one concern were supposed to be of the following composition:

SPECIFICATION A

Sulphur	Not over 0.04
Phosphorus	Not over 0.04
Manganese	0.40 to 0.60
Carbon	0.15 to 0.25

On receipt of these it was found that the carbon in one was very low and there was an absence of manganese in the steel. As this aroused suspicion, several forgings were analyzed with the following results:

	Carbon	Sulphur	Phosphorus	Manganese	Analysis
Forging No. 1	0.10	0.009	0.027	0.005	2104
Forging No. 2	0.10	0.014	0.028	0.005	2114
Forging No. 3	0.46	0.032	0.025	0.529	2146
Forging No. 4	0.10	0.009	0.03	0.004	2147
Forging No. 5	0.46	0.035	0.021	0.553	2148
Forging No. 6	0.14	0.035	0.018	0.434	2149
Forging No. 7	0.42	0.025	0.019	0.514	2150
Forging No. 8	0.13	0.028	0.014	0.494	2151

The forging company claimed the material had been furnished it as 0.15 to 0.25 carbon, openhearth steel, and, no doubt, believed it was safe in using the stock. But had proper precautions been taken to analyze each billet, it would have been spared the humiliation of rejected forgings, and the loss of a shipment of worthless material.

Recapitulation

The preceding tests are only the actual analyses, as taken from the laboratory reports of 1911, and even if exceptional, it must be admitted, are serious enough; but these are indeed but few of the many rejections which have occurred in one year, and are undoubtedly sufficient evidence of the necessity of the closest scrutiny on the receipt of materials of construction. It is very apparent that no manufacturer can afford to trust to luck in the purchase of steel. Hit-or-miss methods have no place in the industrial advancement of today.

It is, indeed, surprising how little manufacturers really know of the steel they are putting into service. Some concerns prepare elaborate specifications, which are difficult to meet, and insist upon each point being carried out in detail; and on the other hand, accept without question the material furnished them.

There are many special steels on the market bearing trade names, which are absolutely dependable for uniformity. It is not intended to criticize these, but rather the indiscriminate purchase of material for all purposes without the guarantee of a check analysis.

It is not altogether the mill or the jobber who should bear the responsibility for faulty steel, for flagrant errors are often made by the purchaser in placing his orders. If his knowledge of steel is limited, as is often the case, and his belief is that "Pigs is pigs" in the matter of bar stock, in that all cold-rolled steel is the same, all machine steel, all nickel or vanadium, he is apt to make his specifications vague and so indefinite that he may receive an entirely unsuitable quality of steel.

But who shall discover these errors from whatever source they come if not the chemist? If it is necessary for an inspection department for the purpose of discovering and eliminating material with pipes, flaws, seams and other defects, why is it not as important to check the quality of the steel by analysis?

Engineering Courses at Columbia

An important step has just been taken by the trustees of Columbia University in raising the requirements of admission to the engineering schools. After July 1, 1914, candidates for admission to these schools will be required to present evidence of such preliminary general education as can ordinarily be had only by taking three years of study in a college or scientific school of high rank.

Thus, in the future, engineering students will be offered the privilege of following a combined college and professional course, covering in all six years, and giving opportunities to a competent student to obtain both a collegiate and engineering degree in that time.

The purpose of this is the better and broader training for students of engineering, and to place the instruction in the professional subject upon the same university plane as the instruction in law and medicine. The recent rapid development of engineering practice, the wider social and public recognition now given to the engineering profession, and the frequent demands that men in executive and administrative posts shall have had an engineering education, make it imperative that the engineer of the future shall be a broadly educated professional man, and not merely a technical expert. In order to insure this, it is necessary that the future engineer shall widen his intellectual outlook by extending his general education considerably beyond the limit of the ordinary high-school course.

It is stated that at the present time nearly 100 students in Columbia University are taking advantage of the existing opportunity to combine a college and engineering course covering six years of study.

Tests made at the Royal Laboratory at Gross-Lichterfelde-West, to determine how repeated melting, heating and cooling affect the chemical constituency and mechanical properties of bearing-metal alloys, show that repeated melting does not make substantial changes in the chemical composition of white metal. The percentage of copper in the alloy increases by about 0.2 of 1 per cent. for each melting, but the ratio of tin and antimony remains the same, although the absolute percentage of these metals in the alloys decreased by about 1.4 per cent. after five meltings. It was further found that when white metal is heated and then cooled, its mechanical strength is favorably affected by rapid cooling, and decreased by slow cooling; slowly cooled metal is about 10 per cent. weaker.

Design of a Band Brake

By T. W. Holloway

Practical formulas applied to an actual case. Conditions of the problem. A design in which theory plays a negative part.

Very few textbooks on design take up the band brake, and those that do usually give it in such a form that it does not readily appeal to the practical man, who, as a rule does not have time to make an extensive study of the subject. It has been my experience that as little theory as possible, together with an illustration of good practice, is the information that the practical designer is looking for, and this is the idea carried out in the following design of a band brake.

A recent design of a hoist required a band brake on the hoisting drum that would hold a load of ten tons on an incline of 60 deg. with the horizontal. The hoisting drum was 30 in. in diameter and the brake wheel on the drum was 50 in. in diameter. The brake band or strap, which was to be made of steel, was to be six inches in width and was to be lined with red fiber, which was assumed to have a coefficient of friction of 0.3. The strap was to have an angle of contact of 270 deg. with the brake pulley. It was necessary to find the thickness of the strap, the leverage required to hold the load and to proportion a suitable foot lever.

Pull at Circumference of Brake Wheel

Pulling a load of ten tons, or 2000 × 10 = 20,000 lb., up an incline of 60 deg. is equivalent to lifting a load of 20,000 × sine 60 deg. through a vertical distance. The sine of 60 deg. is 0.866; therefore the equivalent vertical load is 20,000 × 0.866 = 17,320 lb. The turning moments of hoisting drum and brake must be equal; that is, the product of the pull of the brake band and the radius of the brake wheel must equal the product of the pull on the hoisting drum and the radius of the drum. The radius of the brake wheel is 25 in. and the radius of the hoisting drum is 15 in. Hence, if the pull of the brake band is represented by P, then $P \times 25 = 17{,}320 \times 15$ from which

$$P = \frac{17{,}320 \times 15}{25} = 10{,}392 \text{ lb.}$$

Tension in Brake Band

The band brake may be treated as a belt and pulley where the friction is great enough to prevent rotation of the pulley. Referring to the figure let T_1 be the tension in the pulling end A, and T_2 be the tension in the loose end C of the brake band or strap. It will be noticed from the arrow that the brake wheel is made to revolve toward the loose end of the band, as so doing aids in tightening the band.

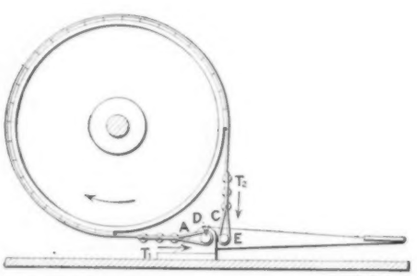
Since P is the pull of the band brake, $P = T_1 - T_2 = 10{,}392$ lb. In the case of the band brake, T_1 corresponds to the tension in the driving side of a belt. The value of T_1 for a band brake may be found by the same formula used for belt calculations. This formula is as follows, the derivation of which requires the use of higher mathematics:

$$Log. \frac{T_1}{T_2} = 2.729\, FC$$

in which

F = Coefficient of friction between the material of the brake wheel and the lining of the brake band;

C = Fractional part of the circumference of the brake wheel in contact with the band;



Design of a Band Brake

T_1 and T_2 have the same meaning as previously given.

The value of

$$C = \frac{270^\circ}{360^\circ} = 0.75$$

and F is taken as 0.3 for fiber. Applying the formula

$$Log. \frac{T_1}{T_2} = 2.729\, FC = 2.729 \times 0.3 \times 0.75 = 0.614025$$

and using a table of logarithms

$$\frac{T_1}{T_2} = 4.111$$

from which

$$T_2 = \frac{T_1}{4.111}$$

Inserting this value in the formula

$$T_1 - T_2 = 10{,}392,$$

the expression becomes

$$T_1 - \frac{T_1}{4.111} = 10{,}392$$

Clearing of fractions by multiplying both sides of the equation by 4.111 the expression becomes

$$4.111\, T_1 - T_1 = 10{,}392 \times 4.111$$

from which

$$T_1 = \frac{10{,}392 \times 4.111}{3.111} = 13{,}732 \text{ lb.}$$

$$T_2 = 13{,}732 - 10{,}392 = 3340 \text{ lb.}$$

Thickness of Band and Size of Rivets

The maximum stress for which the band or strap must be designed is, therefore, 13,732 lb. As the width of the band is to be six inches, the thickness must now be found. Let S = the safe fiber stress of the material, which may be taken as 10,000 for steel, which allows a factor of safety of about 6; W = the width of band; and T = the thickness. The sectional area of the band multiplied by the safe fiber stress must be equal to the maximum load on the band. That is

$$W \times T \times S = 13{,}732$$

from which

$$T = \frac{13{,}732}{WS} = \frac{13{,}732}{6 \times 10{,}000} = 0.23 \text{ in.}$$

or say ¼ in. in thickness. In practice the strap is made the same thickness throughout although at the loose end the area does not need to be so great because of the smaller stress.

The ends of the strap are usually overlapped and riveted as shown in the figure so as to form loops for fastening to the pins D and E. Some of the sectional area of the strap is removed by the rivet holes and consequently the thickness must be increased to give the required sectional area. This is usually done by assuming an increase of thickness and then making a trial calculation to see if the amount assumed is sufficient.

As a trial add $\frac{1}{16}$ in. to the thickness, making the strap $\frac{5}{16}$ in. thick. If six rivets are used at each end and are arranged in two longitudinal rows there will be two rivets side by side or in a transverse row. The load on each one of the six rivets will be

$$13{,}732 \div 6 = 2290 \text{ lb. } \textit{nearly}$$

If the safe fiber stress of the rivets in shear is taken as 8000 lb., the rivet area for one rivet will be

$$2290 \div 8000 = 0.286 \text{ } \textit{square inch}$$

The corresponding diameter is

$$\sqrt{\frac{0.286}{0.7854}} = \tfrac{5}{8}\text{-}\textit{in. nearly}$$

If two ⅝-in. rivets are used side by side the effective width of the strap is

$$6 - (2 \times \tfrac{5}{8}) = 4\tfrac{3}{4} \text{ in.}$$

The effective area of the strap with the assumed increase in thickness is

$$4\tfrac{3}{4} \times \tfrac{5}{16} = 1.485 \text{ sq.in.}$$

The original area calculated when the rivets were not considered was

$$\frac{1}{4} \times 6 = 1.5 \ sq.in.$$

This original area is slightly greater than the new area which was calculated but the difference is so small that a strap $\frac{5}{16}$ in. thick will be perfectly safe.

The rivets may also be checked for crushing. If the strap is $\frac{5}{16}$ in. thick and the rivet $\frac{5}{8}$ in. in diameter the crushing area is

$$\frac{5}{8} \times \frac{5}{16} = 0.195 \ sq.in.$$

The load on each rivet is 2290 lb., therefore, the fiber stress in the rivets is

$$2290 \div 0.195 = 11{,}750 \ lb. \ per \ sq.in.$$

which is not an excessive stress for crushing. The diameter of the rivets may, therefore, be taken as $\frac{5}{8}$ in.

Proportioning Foot Lever

The tension T_2 at the loose end of the band being known, the foot lever may be proportioned to suit the conditions. Assume that a weight of 150 lb. on the end of the foot lever is required to just hold the load. If the distance from the fulcrum D to the end of the lever is 36 in. this distance is to the tension T_2 as the distance from the fulcrum to the pivot E is to the weight on the end of the lever. Expressing this in the form of a proportion

$$36 : 3340 :: DE : 150$$

Solving the proportion

$$DE = \frac{150 \times 36}{3340} = 1.6 \ in.$$

If it is desired to make DE of greater length, the length of the lever must be increased or the weight to be applied at the end of the lever must be greater. It is not advisable to allow a greater weight than about 150 lb., as the maximum weight available under ordinary conditions, at the end of the lever, will be the weight of the operator.

In proportioning the foot lever the load which is assumed to act on the foot plate should not be taken as less than about 200 lb. Even though a man weighing 150 lb. operates the brake he may apply the load suddenly, causing a stress even greater than that of a much greater steady load.

Treating the foot lever as a cantilever beam with a concentrated load at the end, the maximum bending moment is WL, where W is the load in pounds and L is the length of the beam in inches. The resisting moment is $\frac{SI}{C}$ where S is the safe fiber stress of the material; I is the moment of inertia, which for a rectangular shape is $\frac{BD^3}{12}$ where B is the width and D is the depth of the beam near the support; and C is the distance from the neutral axis of the beam or lever to the outermost fiber and is equal to $\frac{D}{2}$. The bending moment must always equal the resisting moment, therefore,

$$WL = \frac{SI}{C}$$

or

$$WL = \frac{S \times \frac{BD^3}{12}}{\frac{D}{2}} = \frac{SBD^3}{6}$$

Taking the safe fiber stress S as 9000 lb. per square inch and substituting in the formula

$$200 \times 36 = \frac{9000 \times BD^2}{6}$$

from which

$$BD^2 = \frac{200 \times 36 \times 6}{9000} = 4.8$$

Now if one of the dimensions is assumed the other may readily be determined. Assuming the breadth B to be, say, 1 in. then

$$D^2 = 4.8$$

and

$$D = \sqrt{4.8} = 2.19$$

or say $2\frac{1}{4}$ in. The breadth of the lever is made the same throughout the length, but the depth gradually decreases toward the foot plate where the depth is about one-half the depth at the support. The foot plate is made about $\frac{1}{8}$ in. thick and may be made eight inches long and five inches wide.

A Chrome-Nickel-Steel Process

Armor plates have been made by many different processes, partly by cementation, partly by superficial hardening, and partly by "through" or "homogeneous" hardening. In the latter case the hardness is not so great that the mass is made brittle; but the projectiles cannot penetrate so far as in the case of the surface-hardened plates.

The Compagnie des Forges et Aciéreries de la Marine et d'Homé courte, in St. Chamond, France, has recently patented a process for the manufacture of steel for both armor plates and shot. The alloy is surface-hardened by cooling, without cementation. The report concerning this steel says that it is well known that the point of transformation, or critical point, of a steel is that where the molecular change in the metal takes place. This point, which may readily be observed when the metal is slowly heated or cooled, varies according to the constitution of the alloy.

The new alloy can assume the following various properties: A fine fracture, with great softness, permitting various cold-working operations; a fibrous fracture, together with great toughness, and flexibility equal to that of the uncemented layers of the usual armor plates under shock; a porcelain-like fracture, together with the hardness characteristic of cemented steel, capable of destroying the points of the projectiles.

The possibility of dispensing with cementation occasions a great saving in cost of manufacture, together with a shortening of the necessary processes; and the absence of coarse grain is an advantage which ordinarily is attained only by long and slow heating.

The alloy is a nickel-chrome steel with high-carbon percentage, the proportions being about as follows: Carbon, minimum, 0.65 per cent., maximum, 0.08; chrominum, minimum, 3, maximum, 4; nickel, about 2.5 per cent.

The manufacturing processes are as follows: After rolling, the plate is subjected to two regular heatings, the first one between 1550 and 1650 deg. F., the second about 1425 deg. F.; that is, to a temperature only a trifle higher than that at which the alloy undergoes a change by the action of the heat. The duration of these heatings depends on the thickness of the plate, but in general the second is longer than the first. The two heatings bring about a fine grain and permit easy cutting of the metal.

The plate is then heated to about 1425 deg. F., and hardened in oil; then reheated to the same temperature, and next hardened in water after a regular reheating to 1200 to 1250 deg. F. As a result, the plate becomes fibrous and has a very great resistance to impact.

Finally the plate is hardened by spraying with water, effecting such successive reductions of temperature that the mass in general retains its fibrous structure, while the chilled side (which is that to be exposed to impact) becomes especially hard and porcelain-like in structure. The mass of the plate must be kept below 1250 deg. F. during this process; the face to be hardened, however, between 1475 and 1550 deg. F.; that is, at a temperature perceptibly above that of the critical point.

Exports to Mexico during the last year show a fall of about 20%, when compared with the immediately preceding year, while imports show also a slight decline but less than that of exports. The total value of exports to Mexico during the 12 months ending with January, 1912, the latest figures of the Bureau of Statistics, Department of Commerce and Labor, is $52,271,987, against $64,671,659 in the corresponding months of the immediately preceding year, a decline of about 12 million dollars, or an average falling off of a little more than a million dollars a month during this period. Imports from Mexico during the same period amounted to $59,227,516, against $59,981,890 during the corresponding period of the preceding year, being less than 1 million dollars decrease.

Colleges and Scientific Discipline

By John R. Godfrey

A few suggestions as to the objects of discipline and the results to be obtained. The bad effects of ironclad and useless rules, of suspension or enforced loss of time and of the spirit of the martinet in any shop.

And now the colleges propose to teach scientific discipline!

Picture their late advocate, R. T. Crane, casually reminding the colleges of the habitual evidences of self restraint practiced by college students after a football game and on similar occasions. From all accounts the students usually have motion study down so fine that every move smashes a head or a plate-glass window.

Of course, it is an entirely different thing to talk about discipline for men who have to follow any old rule a martinet boss may concoct, or lose a chance to earn a living, and discipline for boys who have few responsibilities and who know that colleges want their money too much to fire them all. But, if example is better than precept, a little real discipline in colleges might be a good foundation for the course in scientific management and discipline.

There is no reason why some of the principles of management and discipline may not well be taught in colleges. I sidestep the "scientific" because it has been overworked by every man who has suddenly discovered that it is possible to save the time wastes in almost every line of business. But, the colleges themselves must first learn what real discipline is before they can make a very lasting impression on students or on the community.

Discipline Begins at Home

No college with which I am at all familiar has anything like a scientific discipline. Students are treated in widely varying moods, according to the professor or instructor who presides over their collegiate destinies. They are treated as full grown men in some departments, put on their honor and their mettle by some, and at the next period are subjected to such rules as might be looked for in a kindergarten.

Petty infractions of idiotic rules are treated with severity, and real breaches of the peace, which should mean 30 days in the county jail, are overlooked as "boyish pranks." In one case, inserting a comma where it belonged but which had been omitted from the printed form to be followed in signing a formal statement, called down the wrath of the professor and deducted marks from the boys' average. These rulings show such a childish grasp on the problem of discipline that I may perhaps be pardoned for skepticism as to its being taught in the colleges.

The Real Solution

The real solution of the problem of discipline requires a study in psychology rather than the formulation of any rules for governing a shop. When you see a shop with rules plastered over the walls in every vacant space, you can bank on finding a poorly governed institution. There may be no riots or disorder but the spirit of coöperation which spells real success anywhere, is sure to be missing. The best shops usually have the fewest printed rules.

I remember one shop where we had a martinet for superintendent. His main qualification was that he knew which foundries in town and out, had the different patterns—a sort of animated card index of patterns. And so he was made superintendent. He was also a tin soldier and the orders that were posted up under the guise of rules would have planned an army campaign.

If a water faucet had been left open by an apprentice boy, up went a rule warning everyone against and usually prescribing summary dismissal as the penalty. These proclamations were always ignored and usually became decorated with tobacco juice before they had been up half an hour. The kind of coöperation he received can easily be imagined.

Discipline as an Aid to Production

The main object of any shop is to manufacture machines at as low a cost as possible consistent with good work and with a fair consideration of its men. Or it may be possible to omit putting the latter in cold words, as it will usually be covered by the question of cost and quality in the long run.

Shop discipline, scientific or otherwise, is only a means to the end of economical production, and should be studied with this in view rather than to train a body of men to follow a prescribed routine from one week to the other. And getting the best results means realizing that men are not machines but human beings with little differences of temperament; little failings perhaps, which cannot be trained to follow iron-clad rules, but which do not interfere materially with economical production.

Studying Your Men

Each shop must, of course, have a general policy of shop discipline, but the more this can be kept in the heads of foremen and the less it is flaunted in printed rules, the better. When a foreman has horse sense as well as ability to get out work, he studies his men carefully and learns how to handle them. He praises some men a little, scolds others, touches the vanity of another class, varying his treatment according to the peculiarities of the men. And this is scientific because it secures results without attempting to ignore the individual.

One great difficulty with iron-clad rules is that they often work against the interests of the concern. Even the rule which used to be so common and made men who just missed the stroke of seven lose a half hour or a half day for the second offense, is going by the board.

It is a very easy thing to miss a car or be blocked or even stop to kiss the baby once too often and miss the punch by 37 seconds. But leaving out all consideration for the man, the plant loses the product of both man and machine, so that the satisfaction of maintaining strict discipline costs the firm fully as much as it does the man. And the chances are that in case of dismissal, the next man would be about the same.

Leading Instead of Driving

Most men can be led much easier than driven and when a man is made to feel the time clock too keenly in the morning, he is pretty apt to think about it of his own accord at noon and at night. Time clocks have come to be a necessity in most places, but they do not have to be handled so that men get to hate the sight of them, as is sometimes the case.

Then there is the question of discharge for various offenses, for mistakes and other causes. Years ago in railroad work, men were suspended for various reasons, usually mistakes of some kind, such as most of us are heir to. These involuntary vacations meant hardship to the men and worst of all, to their families, and the company lost their services and experience.

Discipline without Suspension

So a very human master mechanic, George R. Brown of the old Fall Brook R.R., devised a plan whereby men could be taught the errors of their ways by what was called "Discipline without Suspension." This was first published in *Locomotive Engineering* by John A. Hill, now the "old man" of the House of Hill. An outline of the idea can be had from an extract of a recent letter by G. R. Brown, now retired, regarding his plan.

A Master Mechanic's Methods

The employer, to accomplish the best results and keep competent and satisfied employees must demonstrate to them that he is reasonable and just in his discipline and conclusions reached. He

must treat them in a manner he would consider honorable and just if he were in the other man's place, and receiving from him the discipline he is administering. We must remember that no man is infallible. Mistakes have been made by the best of us. That men who are adapted to, and like their employment, will make less errors than those who do not.

It takes a man of well rounded character to give every man a "square deal" under all circumstances.

We must take into consideration that all men are not of the same temperament, intelligence, or physical endurance and not by nature or environment adapted to, and can never learn to successfully follow, the same occupation.

The employee should serve his employer faithfully, intelligently and loyally, following his directions implicitly, so long as he accepts the agreed remuneration and continues in his employ. This is no more than he would expect of men in his employ, and to both employer and employee the golden rule applies.

A large percentage of employees possess the characteristics desired, or can be made to with humane treatment and proper discipline. It is to the employee's interests as well as the company's that those who are not up to the standard of efficiency should be made so, or their services dispensed with. Their own lives and the lives of others are jeopardized by incompetent employees. Efficient men are always ready and anxious to coöperate with the company to improve the service.

The efficiency, loyalty and future availability of individual employees requires more thought and discretion than modern mechanical appliances. The latter are the result of fertile brains, usually patented and sold, ready for use. The former cannot be patented and it takes a superintendent of keen perception to sort out the right men to hire, discipline and standardize according to his ideas of efficiency.

My personal observation and experience demonstrate that in proportion to the number there are more incompetent employers than employees. It is up to the board of directors, presidents and general managers, to secure men, who have the hiring and the disciplining of employees, as competent in their official capacity as they require subordinates to be in their minor capacities.

Every division of the same road should work under the same standard of employment and under the general direction of the head of the transportation department or some one authorized and qualified to get the best results for both employer and employee.

The separate divisions of a large road do not purchase the road's cars, rails, ties and other supplies, and should not be allowed to hire, discipline and discharge employees only under the general direction of the head of that department, or authorized head of an employment department. The standard of employment should be the same everywhere, as in standard appliances, train rules, etc.

My personal experience indicates that it would be profitable for many of the larger roads to employ a competent man to be held responsible for the hiring, disciplining and efficiency of the men through division subordinates, to travel over the road visiting division terminals, becoming acquainted with the men, all irregularities and conditions and with division superintendents, adjust all matters of employment, discipline and records for the entire system uniformly, reporting direct to the designated general officer.

When purchasing new rails an inspector is sent to the mill to see that the best standard ingredients are used in the right proportions, and that every rail turned out is perfect. When placed in the track, each rail gives uniform results, but not so the employees. Each man has characteristics peculiar to himself. No two are alike or will give uniform results, like rails or standard appliances.

The applicant for employment always does his best to impress you favorably. Each man is a separate and distinct proposition and should stand a thorough investigation by competent men to demonstrate his past habits, general good reputation and future availability. If employed it should be with the understanding that he is on trial, and that it remains with himself whether or not he continues in the service. Let it always be remembered, that the applicant for the position of water-boy has aspirations for the presidency. Incidentally, I might say I began as water-boy, at 50c. per day.

The officer held responsible for good service and satisfied employees must have an unusual conception of human nature, a dignity governed by justice, tempered with mercy, and at the same time be firm in the right, demonstrating to the employee that his record, which he makes himself, is the only barrier in his way of continued employment.

The record soon demonstrates his future availability and that he alone is responsible for his dismissal should it occur. The service is improved, the competent and worthy men assured of steady and permanent employment with promotion in turn based on their age and service, past record and future availability.

Frequently, subordinate officers authorized to hire and handle men need looking after and disciplining more than the men working under them. This is one of the many reasons why large roads should employ a competent man to be held responsible for uniform treatment and records of the men by subordinate officials and others.

Improvement, Not Punishment

Some machine firms handle the question of spoiled work in a somewhat similar way. The work which will not pass inspection is used as an example of "how not to do it." The defects are pointed out to apprentices and the reasons given, together with suggestions for remedying them. In other shops the work is plainly labeled with the reasons for rejection and the cost of the spoiled work in both labor and material, thus making an eloquent object lesson.

In most cases the name of the party spoiling the work is not given. The guilty parties know their handiwork and the object is to avoid future mistakes rather than to humiliate and arouse resentment. The damage is done and holding a man up to ridicule is not the way to get his good will and coöperation.

I can fully appreciate the feeling of exasperation which a foreman feels when a careless or foolish mistake has been made, and his idea that discharge is the only thing that can be done. I have felt that way myself. But when I came to think it over calmly and could see straight once more, it has dawned on me that the chances are the man will not make this same kind of a mistake again. It is also extremely likely that a new man will do the very same thing or worse.

Then too, I have found that a sick baby at home has been at the bottom of the distraction which led to the mistake. But whether it is this or the anticipation of tomorrow night's dance, we know that mistakes will be made as long as men are men.

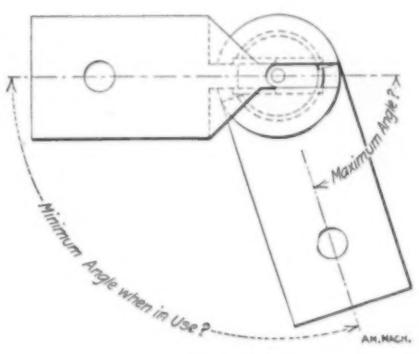
Reducing Mistakes in Different Ways

The real shop manager will endeavor to reduce these mistakes in every possible way and the threat of discharge is probably one of the poorest methods of doing it. The average man in the average shop —which means a shop where he is considered human instead of only a machine —does not spoil work purposely. He knows that mistakes count against him both as to a raise and a lay-off when work slacks off. Every year of service makes a man of more value, for the reason that there are some facts and experiences which cannot be recorded by any card system. We can, therefore, easily see that it pays far better not to be too hasty in discharging or even in judging. We should try to help men to make fewer mistakes and encourage them when they do good work. We are apt to forget that a little judicious praise helps wonderfully at times.

What Angle Can the Universal Link Allow?

By B. Stockholm

As a matter of general interest, I inclose a blueprint of a universal link, asking you kindly to insert in the American



Universal Link

Machinist the question: "What is the maximum angle a universal link can allow between the center lines of two rotating shafts connected by the link, and what is the theory for it?"

No doubt the question, as well as the answer, will be of interest.

A Simple Cost-keeping System

By E. W. Bernhard*

A system devoid of voluminous forms and details, entailing the minimum of clerical work, and readily adaptable to the general run of small-sized shops.

*President, Providence, Autogenous Welding & Manufacturing Co.

The following article shows how one small shop costs each job, accurately and quickly, as socn as it is finished, and, in some cases, when it is half finished, if there is any doubt about the selling price being right. This shop has but one clerk, who, in addition to the time keeping and cost keeping, does practically all the clerical work about the shop and office. This shows how little time is given to the cost end of the work.

Time-clock Application

As the basis of the system, an International time-recording clock was installed with the regulation time cards, Fig. 1; a day card for every man, whatever his position, and a job card for all who change jobs during the week, with one side for day work and the other side for piece work. A clock is almost absolutely necessary where men work on different jobs, to insure proper cost records.

The men have to ring out the finished job and ring in the new one at the same time, in order that the clerk may see all the time shown on the day card properly distributed on the job cards. The clerk or foreman makes out the job cards as the men start new operations or new jobs, but if they are busy, the man rings in a blank card and goes to work. The card can be filled in afterward.

Welding-department Costs

There is a separate series of order numbers for each department so that, by the order number, it is known where the work was done and what to charge it to. As an illustration take the welding department. This is all miscellaneous jobbing, the jobs running from 50 cents to $300 and from ten minutes to four weeks. Five or six men are working on the job. It is not practical to have a separate card for each job to be done in this department so each man has a day card and his time is charged to this department as a welder, helper or oxygen maker.

Any large job would call for separate job cards in order to keep the time, extending over a week or two separate. As each job is received, an order is made out in duplicate and the job is tagged with a number. The sub-foreman gives the job to a helper to prepare and designates the time on the order as machinist's time, Fig. 1. After that the job is welded and then finished up by a machinist. The amount of gas, charcoal, and the welding time are entered on the order. The duplicate order, which is yellow, is then returned to the clerk, who costs the job and the foreman makes the price. This takes the clerk about one minute to an order and there are from five to twenty-five orders a day.

Some jobs require some hours of machine labor after welding. The machinist charges his time to the welding job order number on a regular job card and it is entered on the order. His time for that job is then charged against the welding department and deducted from the machine shop. Special supplies for any particular job would also be put on the order and charged.

The Sherardizing Department

The sherardizing department is somewhat similar to the welding. It only takes two or three men to run the oven but it is impossible to keep separate job cards on each job as they vary from a pound of screws to 15 tons of bolts and nuts. All the work is mixed in the drum at one time and sometimes ten different orders of a similar character are done in one heat, and at others only one kind of material in a heat.

In this department, each man has a day card and his time is charged to sherardizing labor. An order is made out in duplicate for each lot of goods and the goods are properly tagged with the order number. The letter "S" is used for this series, thus "S-190." First the material is carefully weighed and the order made out. Then the sub-foreman takes the duplicate to his job and makes a note of all the times on this lot of goods, Fig. 3. He must be particular to read the gas meter before and after each heat and enter these readings on each order, any part of which is in the oven. These readings tell what goods were in the oven together

Form No. 1006

WEEK ENDING Feb 25 1911

No. 104

NAME. Leo Hahn

DAY	MORNING IN	MORNING OUT	AFTERNOON IN	AFTERNOON OUT	LOST OR OVERTIME IN	LOST OR OVERTIME OUT	TOTAL
MON.	M 6 48	M 12 02	M 12 26	M 5 42			10
TUE.	TU 6 40	TU 12 00	TU 12 25	TU 5 39			10
WED.	W 6 44	W 12 02	W 12 25	W 5 41			10
THU.	TH 6 44	TH 12 01	TH 12 28	TH 5 50			10
FRI.	FR 6 46	FR 12 01	FR 12 27	FR 5 42			10
SAT.	SA 6 47	SA 11 53					5
SUN.							

TOTAL TIME 55 HRS.

RATE

TOTAL WAGES FOR WEEK $

Fig. 1. Weekly Time Card

Providence Autogenous Welding & Mfg. Co.

Providence, R. I. Feb 2 1911 Your Order No. 198

Name R. I. Yacht Co. Bristol R. I. Our Order No. 3561

Please execute the following Order charging all Material and Labor to above number.

Weld 4 Cylinders

Paid

Oxygen used, feet	1009	4 04
Acetylene used, feet	509	2 60
Preheating	2 Bbl. Charc.	80
Welder's Time,	4½ hours	2 70
Machinist's Time,	6 hours	3 60
Total Cost.		14 60

Charged

Cash Sale 16.00

This Order to be Returned to Office when Completed.

Fig. 2. Order Form

SHERARDIZING.

Providence Autogenous Welding & Mfg. Co.

Providence, R. I. March 2 1911. Your Order No. 2-1-69

Name W. I. Gear Co. Our Order No. S 92

	Hours	Amount
Pickling	2½	05
Tumbling	1	34
Brushing	1	59
Loading	2	64
Unloading	3	91
Cleaning	4	1 24
Inspecting and Packing	4	1 49
		5 26

Please execute the following Order, charging all Material and Labor to above number.

810 lbs. Bolts c 1 lb.

Cost

5.26 Labor

1.00 Gas

4.00 Charcoal

6.09 Elec

.25

Gas Meter

146.212

152.605

6 416 40

Heat No. 1 Date Loaded 3-15-11

Hrs. Run 6½ Temp. 1150 Date Unloaded 3-18-11

Order No. Goods Mch. Bolts

Size ½ Pieces 45 000 Lbs. 883

Drum Nos. 3 & 5 Commenced 1 P.M. Finished 1 P.M.

Raw Dust 100 lbs Test 5 Gas 6.09

Total Cost 5 1 25

Charged 17.66

Cash Sale

This Order to be Returned to Office when completed.

Fig. 3. Form Used in Shreadizing Department

and when, as well as the amount of gas used.

When the order is completed he carefully weighs the finished material and puts the last weight on the order, as this work is paid for by the pound and always gains some weight from the addition of the zinc coating. The order is then returned to the clerk to cost and bill. It takes about four or five minutes for each of these orders and there are from five to twenty-five a day.

One can readily see that it is not possible to get an absolutely accurate cost on, say, 25 lb. of ½-in. bolts, as each drum holds 300 lb. and there are three drums in a heat. They may hold more or less according to the class of material which is being treated. For such cases a regular fixed charge is made, based on what large lots cost, with a proper advance in price. The amount of labor put on the order determines whether the material was particularly dirty and took much pickling, tumbling or brushing. The difference in weight, before and after treating, tells how much zinc is used up. The amount of gas is figured from the meter readings. Regular job cards are used on large jobs to get the labor hours accurately. These, added together, plus the percentage for overhead, give the total cost of the job. Such acids as are used for pickling are charged against the department as a supply, because the amount used on each order would be very small.

How the Machine-shop Costs Are Figured

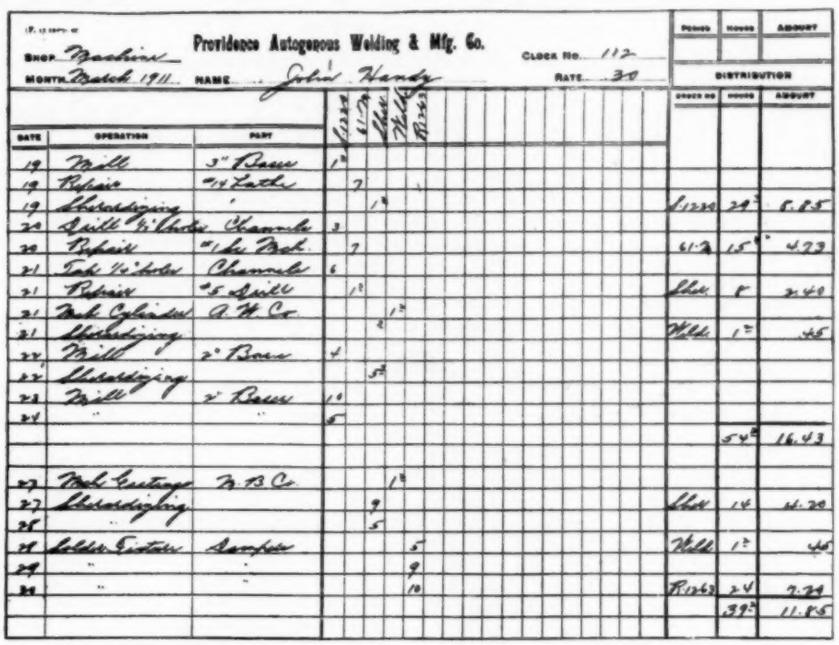
In the machine shop a series of "M" orders is used. Each separate job has an order in duplicate, but in this department the foreman does not enter the time on the order. He returns the order to the clerk, marked "Completed Jan. 1, 1911," with any necessary comment. In this department each man must have his job card made out for each job and separate operation. He does not bother with the order number but simply says, for instance, "Drill four ¼-in. holes in 3-in. dampers." In this way the shop men do not have to be responsible for getting order numbers right.

Thus a man will know what he is doing even if he does not know what to charge it to. If the men are not on a job but engaged in repairing a lathe, rheostat, belt, etc., they get a separate card for it and the clerk charges it to the proper expense number. In this way their entire time is accounted for by the clock.

At the end of the week, the cards are taken from the rack and new ones put in. In the welding and sherardizing departments, the clerk checks the hours on the day card and puts down the total hours worked. In the machine department, he checks the day cards with the job cards for each man and they must agree as to the number of hours. Next he puts the proper order number on each card, and perhaps corrects the wording or names of jobs and operations, as he can easily tell from his orders what is meant on the cards for an operation, even though it is not properly recorded. This takes about an hour or less. He next enters the work of the week in a combined time book and cost book, Fig. 4.

At the top of the page is the man's name, and address, shop, month and year and the rate per hour and the clock number; all the information necessary. At the left is a column for the days of the week. Then a space for the operation and part name. Then columns for the number of working hours on a job, each one headed by the order number. The week's work is written in the book from the cards for each man and summed up.

At the extreme right is a column for the distribution of each week. It is divided into three columns. All the order numbers are entered in the first column; in the second the number of hours worked on each and then the wage total for each order number, which is the product of the hours by the hourly rate. These, totaled, give the number of weekly working hours and weekly wages. Thus the labor cost and pay roll are combined.


Shop Machine — Providence Autogenous Welding & Mfg. Co. — Clock No. 112
Month March 1911 — Name John Handy — Rate .30

| Date | Operation | Part | 1220 | 1220 | 1220

sary to go over the matter in detail and determine the cost for each operation from the time book, which is a copy of the cards. Some recommend keeping the cards filed by the order number and using them for the costing, but they are usually much soiled and the time required to write up the book is only an hour or two each week. Furthermore, it gives a much clearer and more legible record. At the beginning of the month, a new set of pages is started in the loose-leaf time book, as in a small shop a job rarely runs over three months and it is not necessary to refer farther back. The back months are filed away for reference.

Overhead Charges

We come now to the costing of the business, as distinguished from job costing, in order to find out what per cent. to add to labor as an overhead. The fixed charges every shop knows at once, but the question is to find out how much time is consumed in the shop in other ways than on applied or direct labor, chargeable to jobs for customers or manufacture.

By this card system, when a man is not working on a regular order number manufacturing, he takes out a card for whatever job he is doing for the shop and the clerk charges it to the proper indirect expense number. Expenses are divided on the same general principle as a large manufacturing plant. When the payroll is made up from the time book just described, it is analyzed as direct labor, welding, sherardizing and machining, and all other labor is charged to one of the indirect labor numbers. Thus is known each week what proportion of labor is productive and what is nonproductive; what the upkeep of the machines each week is, etc.

All material purchased is charged to an expense number except when for a job direct, in which case a "material purchase" account is used; this is adjusted by the semiannual inventory or oftener if desired. Such labor, material or expense and fixed charge which cannot be charged to any one department, are lumped and divided on an arbitrary percentage basis. For instance, the power account. The machine shop takes 60 per cent, welding 30 per cent. and sherardizing 10 per cent. By these methods at the end of each month are known just what it cost to carry on the business and just how much profit there was in it.

The Northrup Automatic Box-Nailer

A machine for driving nails is not a new idea, but it has remained for Elmer C. Northrup, of San Francisco, Cal., to produce an automatic box-nailer that can be fed with box shooks and turn out complete boxes of better quality than can be made by hand, except at very great expense. The capacity of the machine when running on boxes such as are used in fruit canneries, or about 12x18x18 in., is 500 per hour.

A machine that assembles shooks and nails them at the rate of 500 an hour. Spring compensation for varying thicknesses of wood when driving nails. Boxes exactly rectangular are produced regardless of inaccuracies in the shooks.

Details of Operation

Referring to Fig. 1 the box ends, *AA*, are stacked on each side of the machine

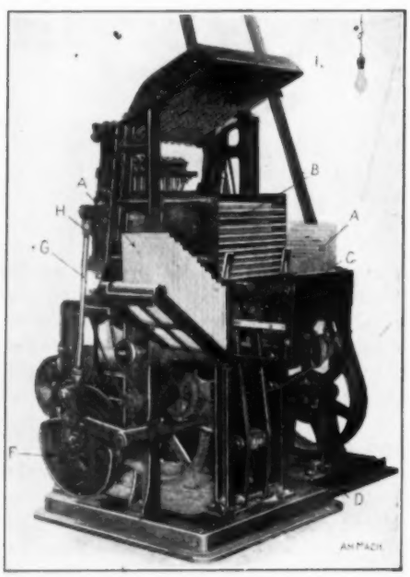


Fig. 1. Front View of the Northrup Automatic Box Nailer with Shooks in the Racks

so that they descend by gravity down an inclined rack to the feeding device. The sides and bottoms are stacked as shown at *B*, two sides being placed between successive bottom shooks and these descend also by gravity toward the feeding device. This feeding mechanism consists of a crosshead which slides horizontally on the guides *C* and which is operated by the upper end of the vibrator *D* which in turn receives motion from the main drive and runs continuously when the machine is in operation.

The sliding crosshead is fitted with dogs which snap out when the crosshead is drawn to the extreme outward position, so as to engage with the edges of the shooks lying next to it and hence carry them backward to the other side of the machine where the nailing is done. An automatic selective device controls the action of these dogs so that the proper shooks are carried forward at each stroke.

In making a box the feeding head carries backward an end shook from each side rack and a side shook from the top feeding rack. The end shooks are pushed between the clamps *E*, Fig. 2 which shows a box in process of nailing. These clamps hold the ends and space them accurately. The lower ends of these end shooks rest on the nailing table and the side shook, which has been fed through with them, rests across their upper ends. The nailing head, *H*, now descends and its plungers *O* force the nails from the nail-holders or chucks, *L*, into the box, nailing the side to the end pieces.

As the nailing head rises the nailing table on which the ends rest swings out of the way, and the clamps, rotating on their axes, turn the box through 90 deg. in time to receive the bottom which has been brought through by the second stroke of the feeding crosshead. The table then swings under the ends again in time to receive the pressure of the nailing head as it descends and nails on the bottom.

Differences Provided for

The difference between the height and the width of the box, if such difference exists, is compensated for automatically by the nailing table, and the clamps grip the ends in such a position that when the box is rotated to receive the bottom it is

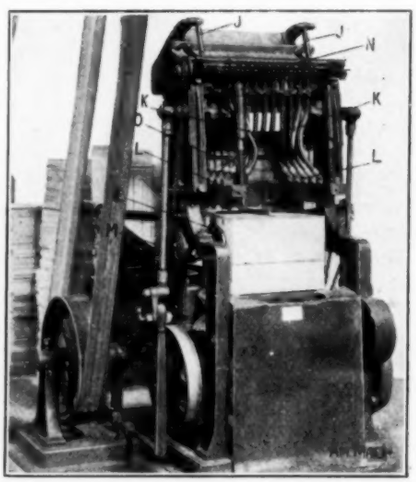


Fig. 2. Rear View of Machine, with the Box in Position in the Course of Nailing

raised to the proper level to receive the bottom as it is fed in by the crosshead. The nail chucks, or holders, can there-

fore be fixed in position and the stroke of the nailing head is constant in length.

When the bottom is nailed the box is again rotated through 90 deg. and the remaining side fed in by the third stroke of the feeding mechanism and nailed by the third descent of the nailing head. The next stroke of the crosshead, which begins a new cycle, brings in two new ends and a new side which kick the finished box out of the machine.

The nailing head *H*, Fig. 1, is operated by the cams *F*, through the rods *G*, there being a cam and rod on each side of the machine. As the nailing head moves up and down it changes the position of the nailbox *I*. This agitation of the nailbox causes the nails, which are thrown into it in quantity, to fall point first into the slots cut in the bottom of the nailbox as shown. When in this position the nails slide by gravity into the stationary nail slots from which they are fed by the automatic nail pickers or cutoffs into the funnel-mouthed tubes *KK*, which carry them to the nail chucks or holders *LL*, Fig. 2.

The chain *M*, which is operated from the main camshaft, controls the nail pickers *N*, which in turn release the proper number of nails into the proper tubes before each downward descent of the nailing head. There are, of course, more nails in the bottom of the box than in the sides, and the distribution is different, so that the selective operation of these pickers is peculiarly interesting. The nails are forced home by the plungers *O*, which are driven by the head through the helical springs shown.

The Compensating Springs

These helical springs play an important part in the operation of nailing. It is, of course, impossible to obtain shocks cut to uniform thickness; and if the plungers were fastened directly to the head the nails would not be driven home on the thin pieces or they would be overdriven in the thick pieces with the added danger in the latter case of splitting the shook.

These heavy coil springs compensate for all such differences of thickness, each nail being driven flush regardless of the thickness of the shook. The nailing devices are set at an angle to the box as it rests on the nailing table, so that the nails go in on a slant, thus cutting across the grain of the end wood and increasing the holding power of the nails.

Not the least important feature of the machine is the fact that it will turn out boxes exactly rectangular and of exact dimensions regardless of inaccuracies in the side and bottom shooks. The ends are exactly spaced by the clamps without regard to variation in length in sides or bottoms, with the result that the boxes will always hold the proper number of cans without looseness or crowding. This is no small matter where millions of small cans are being packed. The bottom shooks can be and often are in two parts, the machine handling them as easily as though they were in one piece.

While there is considerable detail which has been omitted for the sake of clearness, the machine is comparatively very simple. There are no delicate parts to get out of order, and it is rugged throughout. It requires one operator, and a boy to pile the shooks in the hoppers.

The Northrup machines are manufactured by the Automatic Machine Co. of San Francisco, Cal., to whom we are indebted for the information and cuts contained in this description.

Making Engineering Instruments

By Fred H. Colvin

Some of the methods used in making the Ainsworth engineering instruments which include good examples of fixture work for both drilling and milling and show how accuracy is secured on standard machines by using the proper fixtures.

The shop of the Ainsworth Co., Denver, Colo., is the outgrowth and enlargement of a steadily increasing business, which has been going on for a number of years, and which has attained an enviable reputation for accuracy. There are many interesting methods employed in the making of these instruments, some of which should prove suggestive to other manufacturers of fine work, whether in this particular line or not.

As will be seen, they have given careful attention to manufacturing costs, as well as accuracy, and all the devices shown have been made with a view of not only securing accurate results, but of increasing production at a reduced cost.

Particular attention is paid to grinding, practically all cylindrical surfaces being finished in this way. This has been extended to brass tubing as well as steel shafts, with the result that the sliding fits which are secured where one brass piece moves inside another, are proving much more satisfactory than when they were finished in any other way.

Acknowledgment is made to Messrs. Greenwald and Lungren, superintendent and general foreman, respectively, for information and assistance in securing the accompanying illustrations.

Milling Fixtures

The milling of the yoke for the engineer's level, shown in Fig. 1, presents several interesting problems. It is a comparatively light casting of bronze, and

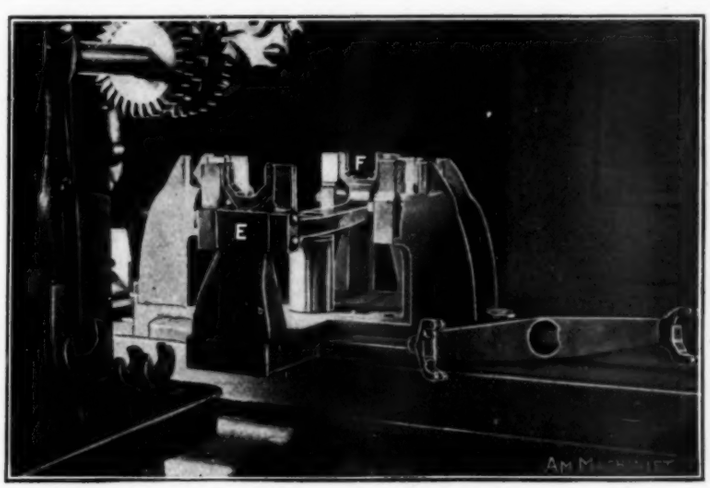


Fig. 1.

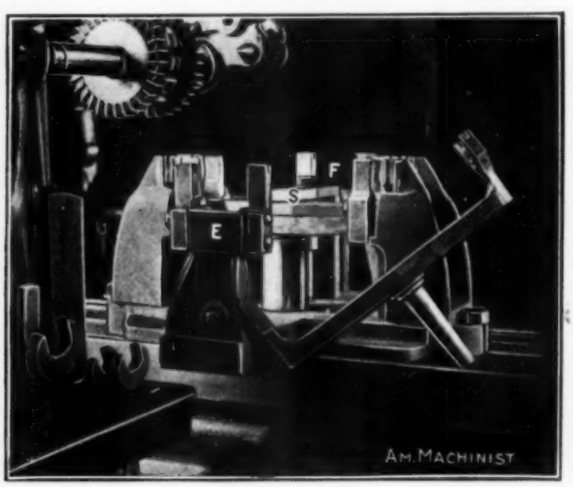


Fig. 2

Milling Fixture for Two Operations on Transit Yoke

must be held so as to absolutely avoid springing in any way. The yoke is centered by its tapered bearings, which fit in a substantial central support in the milling fixture, the end to be milled being supported by the uprights, which not only hold them against the downward thrust of the cutter, but also against the cutting strain of the gang mill. The yoke is clamped in place by the strap *S*, which does not require to be tightened to any considerable extent, as the end of the yoke is well supported against movement in any direction.

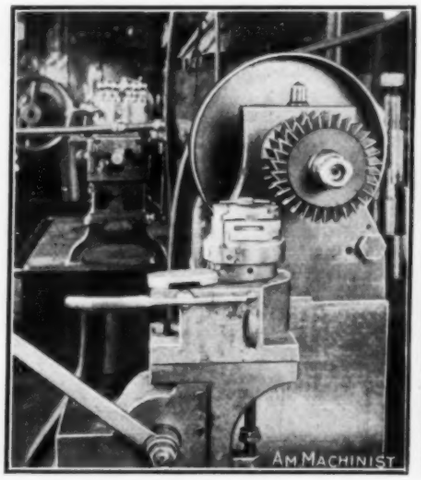
With the yoke held in the position shown in Fig. 1, the gang mill is run through; this finishes the inside of the yoke and also the outer sides, and is accomplished by the inner teeth of the large mills in the gang.

The yoke is then unfastened, lifted out of the jaws which support the end, and turned one-quarter way around until the ends fit in the jaws *E* and *F*, as shown in Fig. 2. The yoke is now in position to have the cross-slots milled, this being done by a special pair of milling cutters, which are located by the opening in the jaws which hold the yoke, and prevent any tendency for it to move under the milling cutters.

Anyone who is familiar with instruments of this kind will appreciate the degree of accuracy which it is absolutely necessary to maintain, but which cannot be adequately brought out in either illustration or description.

A fixture for the hand mirror, Figs. 3 and 4, shows an operation on the hand miller which involves the uses of an ingenious fixture for holding the aluminum bearing plate shown. These are finished, except for the square edges or the sides, the problem being to hold them firmly in place to be milled, and at the same time avoid marring the finished surfaces.

An indexing fixture is employed, having the two upright posts at opposite corners, each post having a groove or notch, which holds the clamping plate. The clamping plate has projections which fit into these notches, and also carries a clamping screw in the center, which holds



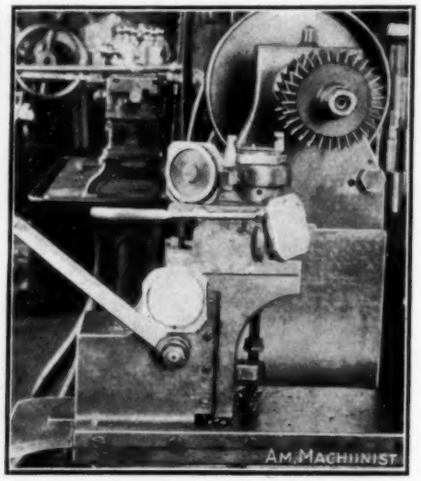
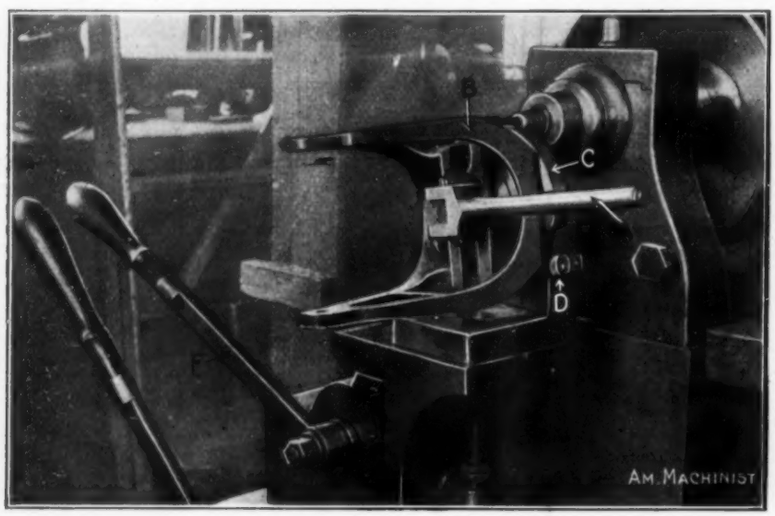


FIG. 3. MILLING ALUMINUM MIRROR HOLDERS FIG. 4



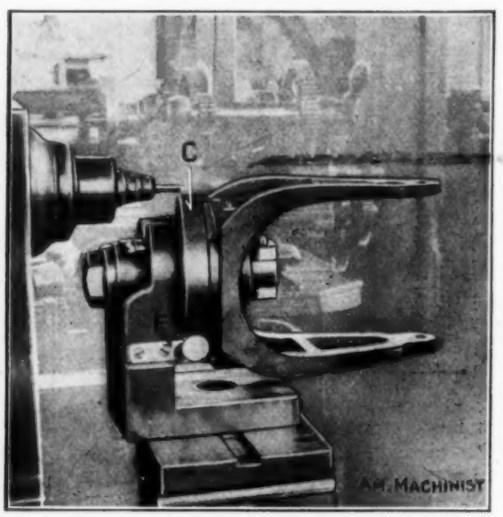


FIG. 5. MILLING ANNULAR NOTCH ON BASE FIG. 6

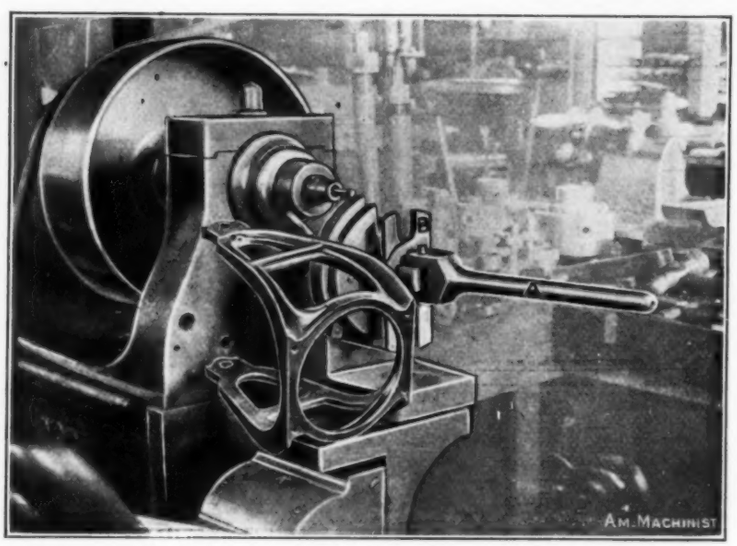


FIG. 7. WITH THE WORK OFF

the finished pieces of aluminum firmly in place, during the milling operation. A pair of straddle mills is used, so that it is only necessary to index the work once to have it completed.

Another Hand-milling Operation

The standard shown in Figs. 5 and 6 has a circular recess milled around the edge of the base, which must be concentric with the bore of the standard. The slot which controls the depth of the recess milled in the edge, the handle *F* raising the whole fixture by means of the usual rack and pinion. The actual milling is controlled by the clamping handle *A*, the operator keeping his hand on this, and swinging the faceplate and the piece being milled through the desired arc between the two stops, giving it any desired rate of feed, which makes a rapid method of handling work.

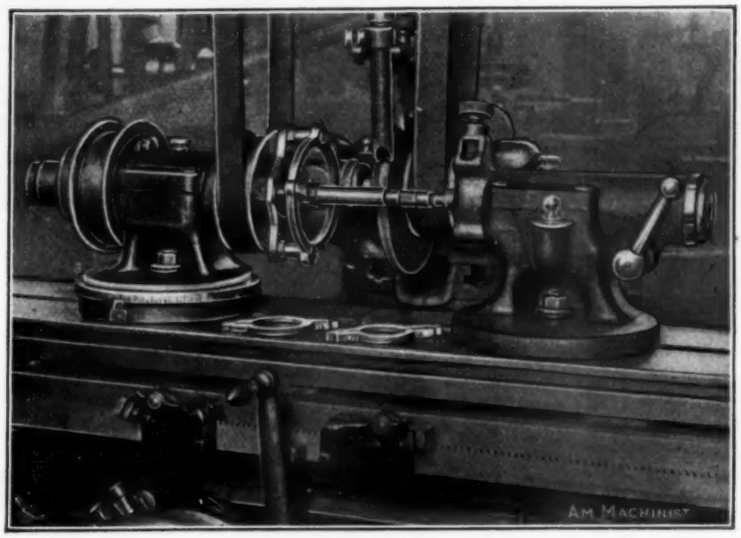


Fig. 8. Balanced Grinder Dog

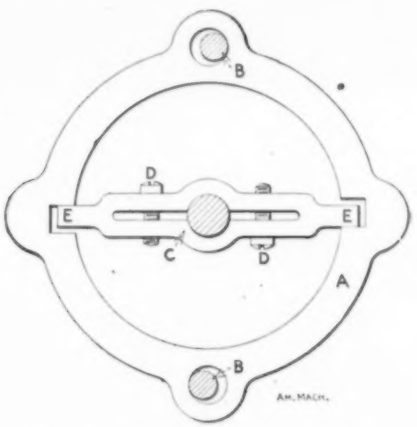


Fig. 9. Details of Grinder Dog

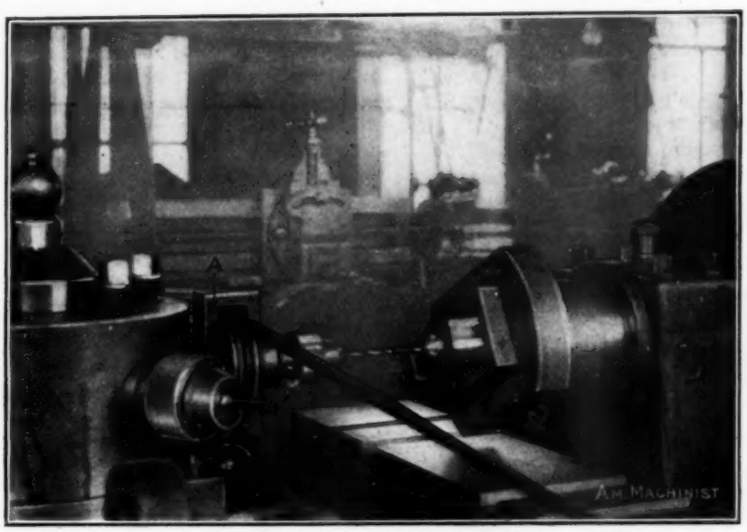


Fig. 10. Drill Speeds for Turret

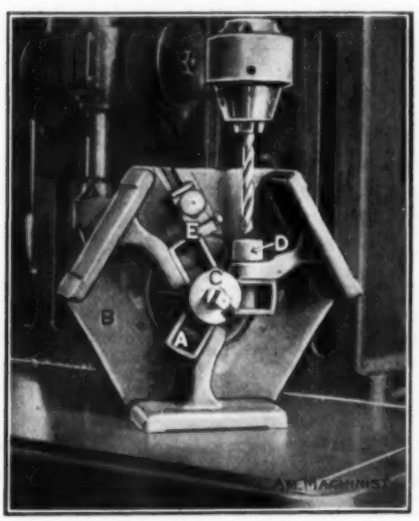


Fig. 11. Ready to Drill

handle *A* is a cam locking lever, which forces the clamping plate or slotted washer *B* down against the inside of the standard face and holds it firmly against the faceplate of the milling fixture *C*. A pin locates the standard in its proper position, so that the stops *D* and *E* control the length of the milled slots to any degree of accuracy desired.

After the standard is clamped firmly to the fixture, the work is raised against the milling cutter until it reaches the straight, forward position. The straddle clamp *B* has been slipped into place to show its relative position with the clamping handle at the faceplate of the fixture.

After the work is done it is only necessary to swing the handle *A* at right angles to the position shown, or in line with the spindle and the standard. This releases the straddle clamp *B*, which is easily slipped out between the openings in the standard, and the whole standard is pulled off over the handles, the fixture then being ready for the next piece.

Details of this are shown fairly well in Fig. 7, where the standard has been removed and the clamping handle *A* is in its

An Ingenious Grinding Dog

A special grinding dog or carrier has been devised by the foreman to do away with all side strain, which comes from unequal driving of the piece to be ground. One of these can be seen in place in Fig. 8. It consists of a carrier which is clamped to the work by means of a slot and a screw for pulling it together, the carrier being driven by its outer end engaging in the ring, which is supported by the two arms on the faceplate shown.

This ring can adjust itself so as to drive the work by an even pressure at both ends of the carrier. This has resulted in a better quality of work, and the device is being used on all cylindrical grinding in this shop.

Two of the carriers are seen lying on the bed of the grinder, underneath the

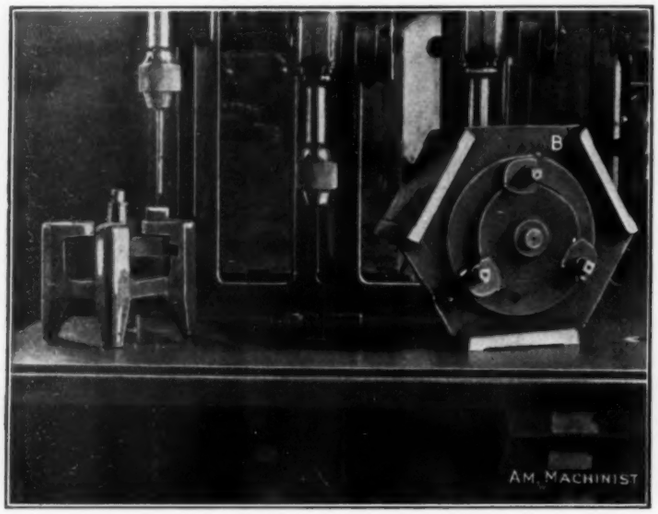


FIG. 12.

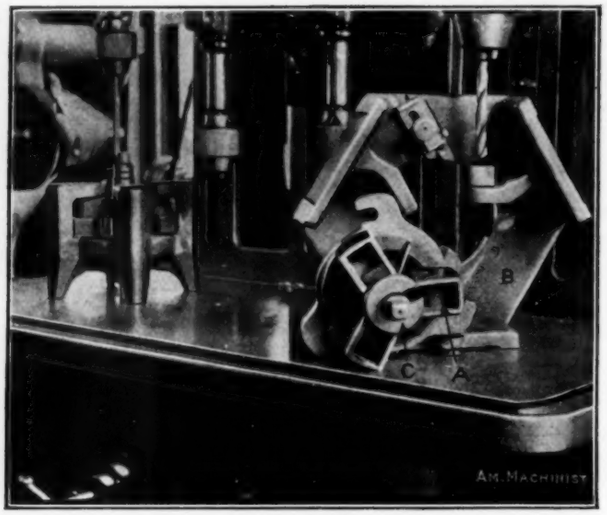


FIG. 13.

DRILLING JIGS FOR TRIPOD HEADS AND LEVELING BASE

piece which is in place between the centers.

A little careful attention to Fig. 9 will show the good features of this design of grinder dog. The outer ring *A* is loosely mounted on the two studs *BB*, and is free to adjust itself on these. The dog or clamp *C* holds the work by means of the two screws *DD*, while the ends *EE* adjust themselves in suitable notches in the ring. This enables the whole arrangement easily to better itself about the axis of the work, and by thus preventing side strain from any direction, avoids the tendency to spring the work, which is too often found when it is driven in the usual manner.

A DRILL SPEEDER FOR TURRET WORK

In order to secure more rapid production in drilling than is possible by using only the ordinary speed of the turret-lathe spindle, a very simple speeder device has been made, as shown in Fig. 10. This consists of the box-like holder *A*, with a projection of the back which fits one of the turret holes and which carries the grooved pulley for the round belt shown. The holder also carries a drilling spindle, mounted in substantial bearings, and including a three-jawed Almond chuck for driving the drill.

The piece of work shown is very small and delicate and is held by the specially shaped jaws shown in the turret chuck. By revolving both the work and the drill, the latter, of course, running in the reverse direction, almost any desired drill speed can be easily obtained, depending on the source of power for the auxiliary drilling spindle or speeder. In this particular case the speeder is driven from a pulley in a lathe, which happens to back up against the turret lathe shown in the illustration.

DRILLING THE TRIPOD HEADS

A very interesting jig for drilling the holes for tripod legs in the tripod head is shown in Figs. 11, 12 and 13. As can be seen, this is rather an awkward piece to hold; the tripod head *A* is mounted on the plate *B* by means of the slotted washer and screw *C;* then the head is pushed through the opening in the center of the fixture and turned so that the three lugs can be held by the collared capscrews in Fig. 11. This brings the three ears to be drilled in their correct positions against the arms which hold the bushings *D*, for drilling the small screw *E*, Fig. 11, holding one of the lugs against the arm, so as to prevent shifting under pressure of the drill.

This same illustration shows the slip bushing in position for drilling the first hole, it being only necessary to put the

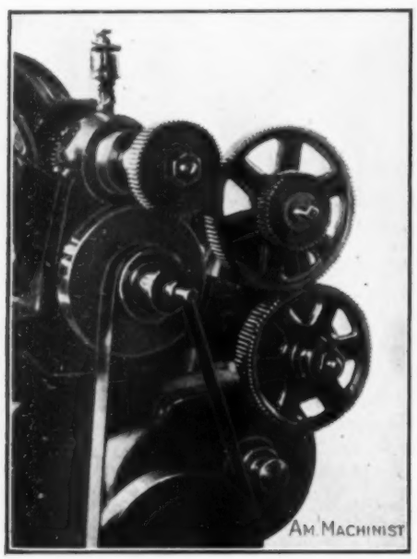


FIG. 14. GEARING FOR ACCURATE THREADS

FIG. 15. PLUGS TO RECEIVE PLATE

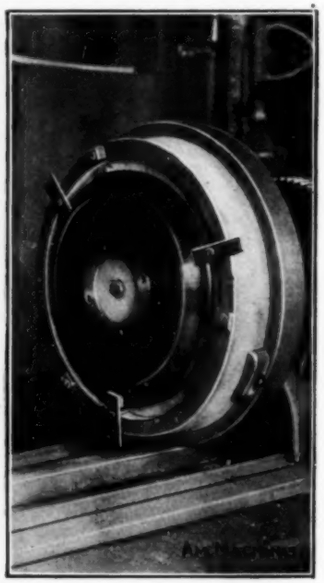


FIG. 16. CLAMPED IN PLACE

bushing in the next hole and roll the fixture over into the next position.

Another drilling jig for the base for the four leveling screws is shown in Figs. 12 and 13. The opening made by the shape of the projecting legs allows the piece to be dropped in from the top and then swung to bring the ears to be drilled under the bushing holes. The slip bushing is moved from one hole to the other, and the four holes drilled quickly and accurately.

Cutting Accurate Lead Screws

Finding it necessary to cut some very accurate lead screws, it was discovered that with the usual gearing between the lathe head and the lead screw on the toolroom lathe, shown in Fig. 14, screws accurate enough for this work could not be produced. In order to eliminate all possible errors, it was decided to gear the lead screw direct from the lathe spindle, this being accomplished, as shown in the illustration, by fastening a bracket to the headstock for carrying the large intermediate gear. This was the only change necessary, and the result was extremely accurate work from the same lathe.

Holding Large Covers Flat

One of the very accurate jobs is to hold the covers shown in Fig. 15 perfectly true and flat for the final finishing. For this purpose a wooden plate is clamped to the faceplate and held by clamps, as at *A*, until it runs true. Inserted in the face of the wooden disk are the brass plugs *B*. These plugs receive the plate and hold it against the small clamping straps, which can be seen around the outer edge. They are faced off every time the wooden disk is put on the faceplate, so as to insure being absolutely true under the conditions existing at that particular time.

One of the plates can be seen lying on the lathe bed, while in Fig. 16 it is shown clamped into place by the three small straps. The central extension on the disk fits the hole in the plate and the whole thing is easily centered and secured in such a way as to insure accuracy and rapid work.

A Four Parted Snap Flask

The four-parted snap flask is the result of an endeavor to increase the production on a line of small double bevel gears which were made in small round metal flasks one at a time. These small flasks were kept constantly employed molding lots of fifty from a large number of different patterns. The continual demand for an increase in the number of castings produced, led to making a four-parted snap flask to take in four gears, which when molded together, would give a larger output than when made one at a time.

Without any alteration in the patterns, but by simply molding four instead of one, the output was doubled and the percentage of waste from the turning shop reduced, as only accurate gears were accepted, a slight movement of one of the bevels or shrouds being sufficient to scrap the gear.

A flask of this description has now been in daily use for 18 months, is still giving satisfactory results and as yet no signs of wear are noticeable in the perfect fit of the parts. This no doubt is due to the fact that the flask is never heated up and steamed with the hot sand as is the case when the ordinary metal flask is used.

The complete flask is shown in Fig. 1, with a curb indicated at *A*, two being used for each mold. These curbs are used direct from the molder, no fitting being necessary, and they are easily replaced when broken or when it is desired to make a larger number of molds per cast. The bosses *B* contain the curb-holder which is shown in section at *C*. The strength of the spring in this is adjusted so that when the curb is pushed into position there is sufficient grip to hold it firmly in place.

All the four flask faces are machined, care being taken to make the four hinges act as one complete hinge, and so one hinge pin is run through the four lugs after the holes have been fitted. The hinge pin is then sawed through at each parting, the separate pins being held in position by means of a small pin driven into the hinge middle lugs.

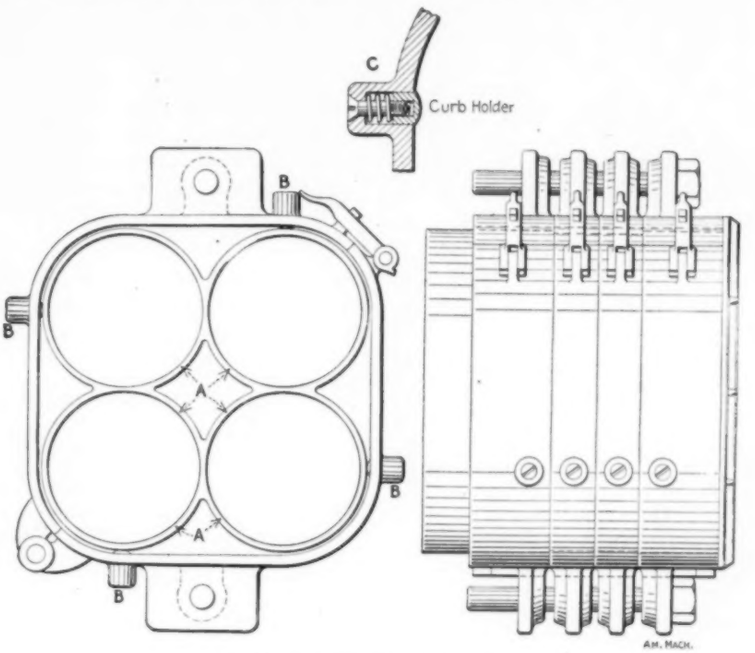


Fig. 1. Four-parted Flask and Curb

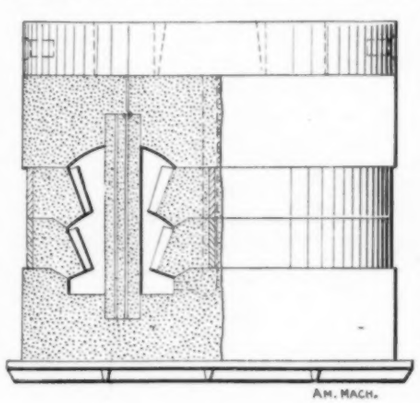


Fig. 2. Complete Mold

The molding does not present any unusual features except in the matter of the number of partings. A cut of the complete mold with curb in position is shown in Fig. 2. It will be noticed that the curbs provide a backing all around the pinion teeth, which has been found to be productive of good results, as it prevents any swells taking place due to one mold becoming filled before the other.

In a bulletin recently distributed by the Bureau of Mines on Liquefied Products from Natural Gas, it is pointed out that by fractionating natural gas, either during or after liquefaction, four products can be commercially obtained. These are: (1) The common natural gas of commerce; (2) the semi-liquid product, known as the new "wild" product, which should be used only as a liquefied gas and should be held in high-pressure steel containers only; (3) the light liquid product, or light gasoline, used for blending with heavy naphthas; and (4) the heavy liquid product, or ordinary high-grade gasoline. The possibility of handling the second product in the way that Pintsch and Blau gases are handled, manifestly opens a new field of comparatively great importance in the natural-gas industry.

Scientific Management in Use

By L. P. Alford

The shop system in the plants of the Link-Belt Co. is frequently referred to as an example of the use of scientific management. A study of this shows that in this particular case the objections of inflexibility, repression of the initiative of the workmen and unstabilizing of the working force are unfounded in fact.

The system has undergone modifications, changes and improvements since its introduction. Its results are satisfactory.

The plants of the Link-Belt Co. are frequently referred to as the best examples of machine shops using the Taylor system of scientific management. In fact at the plant in Philadelphia, Penn., the first installation of this system as a whole was made after Mr. Taylor had carried out his development work at the plant of the Bethlehem Steel Co.

In order to see how the system is being operated and to become acquainted with the broad results obtained, the shops in Philadelphia and Chicago, Ill., were visited. In each plant the system has been used for some time. The work of installation at Philadelphia began early in 1904. At Chicago it was introduced during the last half of 1906 and the year 1907. In neither case is it possible to set a definite date and say that at that time the system was completely installed, for it has constantly undergone development.

At the outset it must be emphasized that none of the plants is a system experiment station. The system was put in as an important part of the manufacturing scheme, and is operated as such; that is, to get production.

As stated, the introduction of the system at Philadelphia began early in 1904, when Carl G. Barth was engaged to secure the necessary fundamental data and oversee the work. Prior to this date the company had secured, from the Bethlehem Steel Co., shop rights for the use of Taylor-White steel, had introduced it into the machine shop and had made many experiments to determine the proper feeds and speeds to be used on cast iron. Furthermore, numerous devices had been tried for expediting the work in the several shop departments and in preparing this work for prosecution by the shop. Most of these were now abandoned but the experience gained through their development and use was retained as a part of the new system.

At the Chicago plant the introduction of the system was begun in June, 1906, and by the end of 1907 all departments were operating under it. Mr. Barth left the company in the Fall of 1908, although the system had been in operating condition for some months before this time. In fact throughout this entire introductory period, he devoted only a part of his time to the Nicetown work; a part of his services was taken by other plants.

It will be noted that much more time was taken by the work of introduction at Philadelphia than at Chicago. The reason for this lies in the fact that at the former plant a great deal of time was spent in securing a basis for accumulating and systematizing proper data, both in regard to the handling of material, and the feeds and speeds to be used with the newer forms of high-speed steels which were then undergoing a constant and progressive development.

Features of the System

The starting point in introducing the system was the accumulating and systematizing of data from which the equipment of the shop could be properly standardized and arranged. The use of these data brought about the rehabilitation of

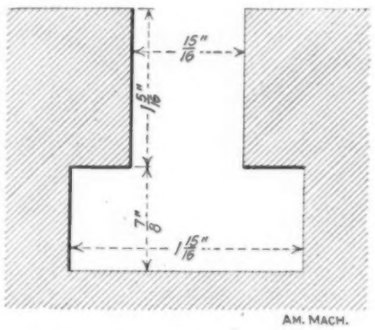


Fig. 1. Link-Belt Co.'s Standard T-slot for 7/8-in. Bolt

the toolroom and small-tool equipment; the reconstruction of the existing machine tools; the purchase of new machines built to special specifications; the introduction of proper feeds and speeds; the rearrangement of the machine tools to avoid, so far as possible, the rehandling of work; the installation of transporting and hoisting devices and the rehabilitation of the storeroom.

Then followed the introduction of time study; the substitution of piece rates determined by this time study for those previously in use; the establishment of a planning department; the introduction of a scheme for routing work through the shop; the rehabilitation of the storeroom records to give a perpetual inventory of all material, parts and supplies on hand; the extension of this continuous inventory to cover material in process of manufacture; the classification of accounts by departments, involving the development of methods to determine both departmental and general expense; thereby permitting of a monthly profit-and-loss showing; the introduction of a detailed drawing for each part, and provision for accurate bills of material.

The central idea in all this was to provide means whereby the work could be thoroughly thought out before it was presented to the shop for execution; and then provide the best possible shop conditions for its prosecution.

It has been stated that there are but two principles underlying rational shop management; these are: The subdivision of labor, and the systematizing and use of accumulated data. Neither is new. The principle of the subdivision of labor was recognized by the earliest writers who considered manufacturing conditions. The second principle is fundamental in every human activity.

If the reader will refer to the first two paragraphs of the section devoted to "Features of the System," he will have no difficulty in arranging the items there listed under these two principles.

It is unfortunate that, in many discussions of shop management, a multitude of so called principles has been given. One writer has given us twelve. This amplification has tended to befog a situation that needs to be seen with the greatest possible clearness. There is no mystery in regard to shop management. As shown, there are but two underlying principles and these have been recognized for many years. The sooner these are grasped and applied, the sooner will we reach a condition that can be accurately described by the expression "rational shop management."

Objections to Scientific Management

The objections commonly urged against scientific management are three in number: Its inflexibility; the repression of the initiative of the workmen, and the unstabilizing of the working force. The conditions observed in the plants of the Link-Belt Co. are of both interest and value as showing that, in these particular cases, the usual objections are wholly unfounded.

To take them up in order, at no time has any part of the system been considered final, rigid and incapable of development and improvement. On the contrary, progressive changes have been, and are now being made. Some parts of the system as originally introduced have been abandoned or superseded by something entirely different, though working for the same final result.

An extract from a letter of Charles Piez, president and treasurer of the company emphasizes this strongly:

Throughout the installation of the system, and since its introduction, we have had no hesitancy in departing from the rigid form prescribed, whenever such departure gave promise of any advantage. If the system had been inflexible, we would have turned it out long ago, for no system subject to that charge could be satisfactorily maintained in a manufacturing establishment.

We have always looked upon the system as a means to an end, as the shortest road from the order department through the works to the shipping room, and we have never given it such an air of sanctity as to prevent us from making radical changes whenever they appeared advisable and gave promise of shortening the road between the terminal points of our works.

The charge that the system represses the initiative of the workmen is at once refuted by the fact that a suggestion system was in use in the Chicago plant during the three-year period from 1908 to 1911. As a matter of fact, the fostering or destroying of the workmen's initiative depends more upon the attitude of the management than upon the use of any system. The initiative can be completely repressed in a small jobbing shop where conditions are as far removed as possible from those prevailing under scientific management. Likewise, initiative can be completely repressed with any of the modern factory systems. On the other hand, it can be encouraged if the attitude of the management is fair and responsive, no matter what the scheme of organization and administration may be.

Returning to the suggestion system that was in use in the Chicago plant, this was started in February, 1908, and discontinued in February, 1911. Under it suggestions were invited from everyone with the exception of the executives. Three prizes were awarded monthly. This means that over 100 suggestions were accepted and paid for while the system was in use. It was discontinued for the often observed reason that all of the suggestions worth while were exhausted.

When such a system is first put into use, a flood of suggestions is called out, many of which may have been thought of for a long time before being expressed. As time goes on, it becomes more and more difficult to offer suggestions that are worth while. Thus the continuance of such a system empties the reservoir of possible suggestions and finally a condition of exhaustion is reached. The so called failures of many such systems are due to this cause alone. The figures giving the totals of the suggestions received during the three-year period mentioned substantiate this claim in an interesting way.

During 1908 suggestions numbering 298 were received. In 1909 this total dropped to 136. During 1910 only 41 were received. This last total was influenced, to a certain extent, by a modification in the rules governing the kind of suggestions that could be made.

The third common objection to scientific management is the unstabilizing of the working force. It is claimed that the men are compelled to work at high speed, are under excessive nervous tension, and finally seek relief by leaving their jobs. Put a little differently, it is stated that men are constantly coming and going in plants operating under the system to the disadvantage of themselves and the shop. Were this objection well founded, it would be serious, for long periods of service on the part of employees in a

OBSERVATIONS OF HAND WORK ON *Machine Tools*

TIME FOR *Putting Wheels in Gear Cutters and Removing*

OBSERVER'S NAME, *L. Klauke* — MACHINE, *Brown & Sharpe Gear Cutters*, Builders' No. 3, 4, 5, 6.

WORKMAN'S NAME, *Walter Norgrave* — DATE, 6-29-05. — PIECE, *Shop No.* 111, 112, 113, 117, 118, 119, 123; 4c., 7c., 8c., 5c., 6c., 2c., 3c.

WEIGHT, *Up to 2000 Lb.*

Handling Time Found on Ins. Card	Preparation	Time for High Rate
4470	Extra time for setting and removing first wheel	0.110
4472	Changing arbors (not allowed on 6c., and 7c	0.075
4475	Setting cutters, all kinds	0.065
4479	Setting roughed out wheels to cutters	0.019

	Operations	Handled by Hand Up to 100 Lb.	Handled by Hoist Yale & Towne 4000 Lb. Triplex: Above 100 Lb. Up to 500 Lb.	Above 500 Lb. Up to 1000 Lb.	Above 1000 Lb. Up to 2000 Lb.
1	Roll or carry wheel to machine, 10 ft. away	0.00250	0.00250	0.00350	0.00350
2	Put mandrel bushing in wheel	0.00250	0.00250	0.00333	0.00333
3	Put chain on wheel (around rim) and on hoist hook	.....	0.00133	0.00133	0.00133
4	Chain draw taut (by hoist)	.....	0.00100	0.00100	0.00100
5	Hoist wheel (L-216)	.....	.....	.....	.....
6	Trolley wheel to position	.....	0.00167	0.00167	0.00167
7	Put wheel on arbor	0.00167	0.00383	0.00383	0.00383
8	Remove chain from hook and from rim of wheel	.....	0.00083	0.00083	0.00083
9	Trolley hoist away	.....	0.00067	0.00067	0.00067
10	Bridge hoist away	.....	0.00183	0.00183	0.00183
11	Put nut on arbor	0.00200	0.00200	0.00200	0.00200
12	Tighten nut, up to $1\frac{1}{2}$" $t = 0.002$; above $1\frac{1}{2}$" $t = 0.00167 + 0.0025$ B	.....	.....	.....	.....
13	Run up back nut	0.00083	0.00083	0.00083	0.00083
14	Adjust screw in rim rest	0.00133	0.00133	0.00133	0.00133
15	Start machine, feed in	0.00083	0.00083	0.00083	0.00083
16	Run cutters	0.00133	0.00133	0.00133	0.00133
17	Stop machine	0.00033	0.00033	0.00033	0.00033
18	Feed out catch back	0.00150	0.00150	0.00150	0.00150
19	Run cutters back	.....	.....	.....	.....
20	Loosen arbor nut	0.00167	0.00167	0.00217	0.00217
21	Remove arbor nut with wrench	0.00117	0.00117	0.00117	0.00117
22	Run screw back in rim rest	0.00117	0.00117	0.00117	0.00117
23	Force wheel loose $F = 0.00167 \times B$ (diameter of bore in inches)	.....	0.00183	0.00183	0.00183
24	Bridge hoist to machine	.....	0.00067	0.00067	0.00067
25	Trolley hoist to machine	.....	0.00133	0.00133	0.00133
26	Put chain around rim and on hoist hook	.....	0.00100	0.00100	0.00100
27	Chain drawn taut by hoist	.....	0.00250	0.00250	0.00250
28	Remove wheel from arbor	0.00133	0.00067	0.00067	0.00067
29	Trolley wheel to one side, 5 ft	.....	0.00383	0.00383	0.00383
30	Lower wheel to floor (L-216)	.....	0.00083	0.00083	0.00083
31	Remove chain from hook and wheel	.....	0.00083	0.00083	0.00083
32	Remove bushing from wheel	0.00083	0.00167	0.00167	0.00167
33	Put tag on wheel	0.00167	0.00250	0.00350	0.00350
34	Roll or carry wheel to one side (10 ft.)	0.00250			
	Total minimum time, operation 5, 12, 23 and 30 not included	0.02516	0.04598	0.04531	0.04931

Handling Time to Allow	Bore of Wheel				
	2"	0.0476	0.0875	0.100	0.112
	3"	0.0540	0.0937	0.107	0.118
	4"	0.0603	0.100	0.113	0.124
	5"	0.0666	0.106	0.120	0.131
	6"	0.0726	0.113	0.126	0.137
	7"	0.0790	0.119	0.132	0.143
	8"	0.0852	0.125	0.138	0.149
	9"	0.0915	0.131	0.144	0.156
	10"	0.0977	0.138	0.150	0.162
	11"	0.104	0.144	0.157	0.167
	12"	0.110	0.150	0.163	0.174

Minimum handling time + 50% = Time allowed

Made.	10-16-07	Revised						*D. V. Merrick*	L—435

TABLE 1. SHOWING TABULATION OF HANDLING TIME

manufacturing plant are a real asset, though one impossible to express in dollars and cents.

That there is no lack of stability in the machine shop force is shown by the following percentages worked out from the records of the Philadelphia plant. Of the men now employed 7 per cent. have been with the firm for over 20 years; 11 per cent. over 15 years; 36 per cent. over 10 years, and 72 per cent. over 5 years. There are very few machine shops in this country that can equal this enviable record. In considering these percentages it should be particularly noted that they are from the machine shop, the department whose operatives are peculiarly affected by the operations of scientific management.

Turning to the question of wages, which are said to tend downward under this system, the records of ten men, who were full-fledged machinists in 1904, have worked continuously during the introduction of the system, and are still employed were investigated. In 1904 the average hourly rate for these ten men was 30.7 cents per hour. The comparable figure for 1911 is 39.7 cents per hour—an increase of about 30 per cent.

From observation, the conclusion must inevitably be reached that the men in the Philadelphia plant represent a very high class of workmen. It can hardly be believed that their gathering is a mere accident. On the contrary, a deliberate attempt must have been made to so arrange shop conditions that the men would find their work not only profitable but pleasant.

The Chicago plant cannot show such conclusive figures as those given above. But we must remember that Philadelphia is a much better labor market for skilled mechanics than Chicago. Furthermore, the latter plant is located in the stock yards district, a locality which is undesirable from a number of viewpoints.

General Results of the System

The test of any system is the result of its use. The most important result to look for is the effect on profits. At the Philadelphia plant profits have not shown any increase since the year 1906, over those that prevailed in the immediate preceding period. However, the firm has succeeded in maintaining and strengthening its business position, in spite of constantly increasing competition and a reduction of prices. At the Chicago plant there has been a fair improvement in earnings since 1906.

It is, of course, impossible to state definitely that these satisfactory conditions have been brought about entirely through the introduction of scientific management. We can, however, state that the system, in spite of the great expense of its installation, has not had an unfavorable influence on the net earnings. A direct advantage to the Chicago plant is the elimination of strikes and threats of strikes. Prior to 1906, labor troubles were frequent.

The main advantage from the company's viewpoint is an indirect one. Failures to keep promises of shipment are far too common in machine shops. Since the introducing of the system, predetermined shipping dates are kept in the majority of instances. During the month of January, 1912, 73 per cent. of the orders were shipped on for before the date specified by the customer. This is an average showing. When we consider that many of these dates were set by the factory and not by the customer, it will be seen that the customer's wishes were very largely met. The influence of this course in promoting good feeling and adding to that valuable asset, "good will," is impossible to measure. Yet no one can deny that it is of considerable value to any manufacturing firm.

Broadly, this is summed up in the advantage of control. Certainty is substituted for guesswork and conjecture. The progress of the work through the shop is known at all times and can be hastened or retarded depending upon business needs.

Specifications for Machine Tools

As an appendix, it is of interest to show a specimen specification for a machine tool, as all machines now purchased by this firm are ordered in this way. The following is a specification issued under date of March 7, 1911, for one 34-in. King boring mill:

This boring mill is to be a 34-in. vertical turret machine as built by the King Machine Tool Co., of Cincinnati, Ohio, complete with countershaft. The countershaft is to be located on the frame of the machine. The machine is to have the following special features:

1. Parallel keys are to be used wherever possible instead of Woodruff keys, particularly in the wormshaft for the turret feed.

2. The jaw clutch is to be made of steel instead of cast iron.

3. The horizontal and vertical feeds are each to be eight in number and arranged in a geometrical progression. The vertical feeds are to be half of the horizontal; all as given below:

Horizontal Feeds, per Revolution	Vertical Feeds, Inch per Revolution
0.0194	0.00968
0.0301	0.0151
0.0452	0.0226
0.0678	0.0339
0.105	0.0527
0.164	0.082
0.246	0.123
0.369	0.184

4. The speeds are to be 12 in number, arranged in geometrical progression and as follows:

Speed No.	R.p.m.	Speed No.	R.p.m.
1	3.93	7	25.1
2	5.37	8	34.3
3	7.33	9	46.7
4	10.1	10	64.3
5	13.8	11	87.8
6	18.8	12	120.0

Further, these are to be identical with those on the last two 34-in. King mills installed in the plant of the Link-Belt Co. at Chicago.

5. The table is to have a three-jaw, combination chuck with T-slots milled to conform as nearly as possible to the Link-Belt Co.'s standard slot for ⅞-in. T-head bolts, a sketch of which is attached hereto. [See Fig. 1.]

Table of Handling Time for Cut Gears

Table 1 is of interest as showing the method in which handling times are worked out and tabulated, and further as showing the actual handling times used in cutting gears on Brown & Sharpe gear cutters. The table is self-explanatory. The master columns are arranged according to the weight of the gears. The heavier ones are handled by a hoist, the lighter by hand. At the bottom of the table will be noticed the statement that the time allowed equals the minimum handling time plus 50 per cent.

From this time study of the handling time the man's time is taken. The machine time is figured as follows:

$$\frac{\left(\begin{matrix}(Width\ of\ face + extra\ for\ clearance)\\ \times\ number\ of\ teeth\end{matrix}\right)}{R.p.m.\ of\ cutter \times feed\ p.r.} = time$$

Example:

$$\frac{(2 + 2) \times 100}{78 \times 0.0408} = 125.68\ minutes$$

Roller Bearings for Loose Pulleys

By H. H. Segner

We have tried numerous ways to overcome the trouble that nearly all loose pulleys give, and have found the solution in the roller bearing. What led us to try this was a particularly stubborn case on a small grinder countershaft in our tool room.

When purchased, this machine had a loose pulley that was provided with what looked like a good method of oiling, and though the oiling was properly attended to, it soon began to give us trouble.

One of the methods tried was drilling a hole in the end of the shaft leading to the loose pulley. This was tapped and a ¼-in. pipe nipple and elbow with a plug in it was fitted. The hole was filled with wicking to retain the oil. This was filled every morning, but was soon as bad as all the other things we tried. Finally the tool maker said he was going to try rollers in the pulley, which was done as follows:

The shaft, which was worn and badly cut where the loose pulley ran, was turned down and the pulley bored out until ¼-in. rollers could be inserted. These were made of cold-rolled steel, not hardened. Provision was made for oiling through the hub of the pulley as before. This shaft was put in place and has been running about a year without giving the least trouble.

Since then, as the loose pulleys around the shop begin to give trouble, they are successfully treated in the same way. One case in particular I wish to cite. This was on a 20-in. vertical driller, which, on account of lack of room, we had to set at right angles with the line shaft and run with a quarter-turn belt. A quarter-turn belt is not easily shifted, and we were unable to set the machine so that the belt would entirely leave the loose pulley when on the tight one. Consequently, the loose pulley did not receive the oil it should, and soon ran dry and cut.

We treated this to the roller cure, and it has now been running about six months without any attention except oiling when the belt is not running.

Manufacturing Theta Tubing

SPECIAL CORRESPONDENCE

This tubing, known as Jacobs' theta tubing, is a special-shaped tube which combines maximum strength with minimum weight, very desirable qualities in many branches of manufacturing industries. Bicycle and motorcycle frames, aëroplane frames and many light vehicle frames call for more strength than is obtained at present with round tubing. Aëroplane frames call for a maximum strength with minimum weight, as well as a very low head resistance.

Theta tubing is so called because of its cross-sectional shape resembling the Greek letter Θ. In a description of the tube we have the walls and the diaphragm or bridge. These tubes are made of sheet alloy steel which, when oil treated, has its tensile strength increased by 60 to 75 per cent.

The material is ordered in long strips, and the width is equal to the contour of the tube plus the length of the bridge, or diaphragm, with a very small percentage of extra width to serve as stock in welding. Fig. 1 shows the shape of the sheet as ordered. The thickness of the tubes as made up to the present time lies between Nos. 20 and 24 B.w.g.

The sheet is bent for the first operation with the walls of the passages at right angles to the diaphragm. This is done on a tinner's folder. Fig. 2 shows the sheet as bent. Fig. 3 shows the mandrel which is used for bending the walls of the tube about. This mandrel is made the exact size of the passage so that when the walls of the passages are bent about it the shape is approximately correct.

In Fig. 4 are seen the two mandrels as placed ready for bending the walls of the passages about, with the arrows showing the direction of the bend. Fig. 5 shows the tube as it is taken off of the mandrels. The shape is made approximately correct on the mandrels.

A clamping device, which is used for holding the tube to the correct shape and keeping it straight for welding, is illustrated in Fig. 6. These clamps are machined on the inside to the correct contour of the tube. The U-clamps *AA* are made self-aligning, so that the tube is straightened when inserted. The dowel pins *BB* prevent the clamps from sliding apart longitudinally. The handled set-screws *CC* are used for adjusting the two halves of the clamping device, making the long diameter of the tube correct.

The tube in position in the clamp during the welding operation is shown in Fig. 7. This figure also shows the position of the oxyacetylene burner flame playing on the stock to be welded. The tube is welded on one side for a distance of about one inch at several places in the length, the clamps are then turned over and the tube welded on the other side. This tacking is done to prevent the tube from being strained too much by cooling, and also that the tube may be as straight as possible where clamped.

The extra stock of the tube is melted down to the main body or to the ends of the diaphragm. Extra stock for filling up completely is added by fusing in material from the welding stick, which is a good grade of material. The fused portions of the tube, with the welding stick added, are shown in Fig. 8 at the blocked portion of the cross-section of the tube. The space to be filled is rounded out some in order to insure having the welded portion of a thickness equal to or greater than the thickness of the walls of the tube.

This extra stock is ground off on the emery wheel, thus making the welded portion as smooth as the remaining material of the tube. Fig. 9 shows a cross-section of the completed tube. The pressure of the flame forces some metal inside of the tube, which makes fillets on both sides of the diaphragm. Fig. 10 shows the tubing as used in aëroplane construction. The end of the tube is beaded, thus fitting in a groove in the clamp, effectually preventing all tendency to pull out while the clamp is bolted together. At present a machine is being designed to roll this tubing out of flat sheets, and another is being designed for welding the tubing.

This tubing is the invention of H. W. Jacobs, assistant superintendent of motive power of the Atchison, Topeka & Santa Fé Ry., and made by the Air Light Metal Co., Atchison, Kan.

Fig. 1 Shape of Sheet

Fig. 2 Sheet Bent

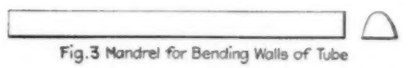


Fig. 3 Mandrel for Bending Walls of Tube

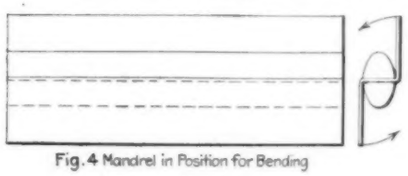


Fig. 4 Mandrel in Position for Bending

Fig. 5 Tube after Bending

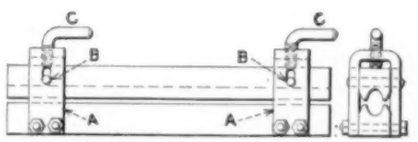


Fig. 6 Device for Clamping the Tube

Fig. 8 Tube Fused

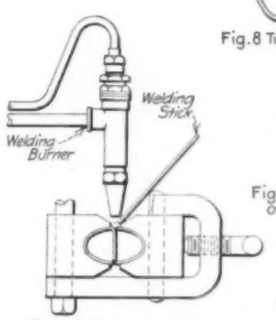


Fig. 7 Tube Clamped During Welding

Fig. 9 Cross-Section of Completed Tube

MAKING JACOBS' THETA TUBING

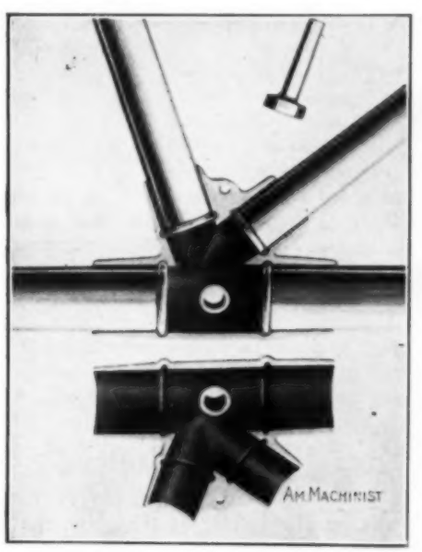


FIG. 10. JOINTS OF JACOBS' THETA TUBING

Labeling Photographic Plates

By George F. Summers

It frequently happens that a machine shop has a camera in its equipment and occasionally makes glass negatives. The following describes a method for marking these plates in a neat and orderly manner with numbers, dates, description of the article photographed and whatever other information is to appear on the finished print.

The illustration shows a plate labeled in this manner. The first number represents the envelop in which the blueprint

Labeled Plate

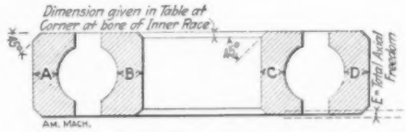
proofs are kept, each subject having an envelop. This is for convenience in finding the glass negatives. The second number is the serial number of the plate. The date when taken and a brief description follow.

To make this label, the camera is prepared by tacking a small piece of pasteboard on the inside of the box in such a way that it blocks off a certain part of every plate exposed. The exposure is taken in the usual way, the area behind the pasteboard being unaffected by the light. Before developing the plate, it is placed in a printing frame behind a piece of plain glass, which has been painted over all but a small rectangle in one corner corresponding with the unexposed place on the plate. Care should be taken to have the two rectangles match.

The label is printed on the typewriter on thick paper with a black coating on the back, which is made by reversing a sheet of carbon paper behind the label while the typewriting is being done. This paper label is now placed in the frame and a second exposure of the plate is made; two seconds under an electric light is enough for this. The plate is then developed and printed, resulting in a label on each print made from that negative.

Tolerances for Ball Bearings

The accompanying standards were recently adopted by the Society of Automobile Engineers.



Tolerances for Ball Bearings

The tolerances are given in regard to outside race diameter, bore and width in Table 1. The limit of eccentricity is given in Table 2, and the total axial freedom is given in Table 3.

Bearing Numbers	Outer Race Diameter			Bore			Width		
	Plus Limits	Minus Limits	Total Limits	Plus Limits	Minus Limits	Total Limits	Plus Limits	Minus Limits	Total Limits
200 to 204	0	0.0006	0.0006	0.0002	0.0004	0.0006	0	0.002	0.002
300 to 303	0	0.0006	0.0006	0.0002	0.0004	0.0006	0	0.002	0.002
205 to 215	0	0.0008	0.0008	0.0002	0.0004	0.0006	0	0.002	0.002
304 to 316	0	0.0008	0.0008	0.0002	0.0004	0.0006	0	0.002	0.002
403 to 411	0	0.0008	0.0008	0.0002	0.0004	0.0006	0	0.002	0.002
217 to 222	0	0.0012	0.0012	0.0002	0.0004	0.0006	0	0.002	0.002
314 to 319	0	0.0012	0.0012	0.0002	0.0004	0.0006	0	0.002	0.002
412 to 416	0	0.0012	0.0012	0.0002	0.0004	0.0006	0	0.002	0.002

TABLE 1

	The Limits of Eccentricity			
	A	B	C	D
Plus limit	0	0	0.0002	0.0002
Minus limit	0	0	0	0

TABLE 2

Size of Balls	E = Total Axial Freedom
$\frac{1}{4}$" to $\frac{1}{2}$"	0.005 to 0.010"
$\frac{1}{2}$" to 1$\frac{1}{2}$"	0.008 to 0.015"
$\frac{1}{2}$" to 1$\frac{1}{2}$"	0.010 to 0.020"

TABLE 3

The Economy of Inserted Tooth vs. Solid Milling Cutters

By C. A. Rogers

The question as to which of these two types of cutters is the more economical has been raised by many who have had to do milling on large quantities of parts. I have seen very little published on the subject and the following experience is detailed with a view to eliciting further information.

The job in mind is the milling of plates 6 in. wide and 26 in. long in quantities that are ¼-in. thick. These are of tank steel. They are milled along each edge and then crosswise ⅛ in. deep, so that when finished there are eight elevations, 2¼ in. wide by 8¼ in. long, running across the plate. The operation of milling crosswise is the one under consideration.

Conditions of Tests

There are nine cutters 7 in. in diameter with a 3-in. hole. The two at the ends are 2-in. face; the seven between are ¾-in. face. Both sets of cutters are of extra special high-speed steel of the same quality. The peripheral speed is 60 ft. per min.; the feed is 4 in. per min., in this particular case. A cutting compound is used on the work and cutters. The first cost of the solid set was $140, and for the inserted set $55.

The two sets were used alternately, that is, one set was in use while the other was being milled. Three hundred plates or 225 ft. were milled at each grinding, as it was observed that there was little or no difference in the length of time the two sets would cut satisfactorily after each grinding.

This was kept up until 12,700 plates, or 9525 ft. were milled with the two sets, each set milling 6350 plates. Each set of cutters was reduced in diameter $\frac{3}{16}$ in. by grinding. At this rate, 25,400 plates would be milled by each set before the solid cutters were worn out or the inserted set required new teeth. The latter could, of course, be inserted at low cost, while with the solid cutters the entire set must be replaced.

Inserted Tooth Form Favored

Admitting a further use for the solid cutter, there would still be left a large margin in favor of the inserted-tooth cutter; and further, should a tooth in the solid cutter be broken, or cracked in hardening, this would form but another talking point for the inserted-tooth type.

I have found that a nicked-tooth cutter will not stand up as long as a plain one at one grinding, and, so far as I have been able to determine, it takes just as much power to drive it, although on wide cuts the nicked tooth has been found the best. The inserted tooth has proved the best for keyseating, as alternate teeth can be driven in and out to maintain a standard width of cut.

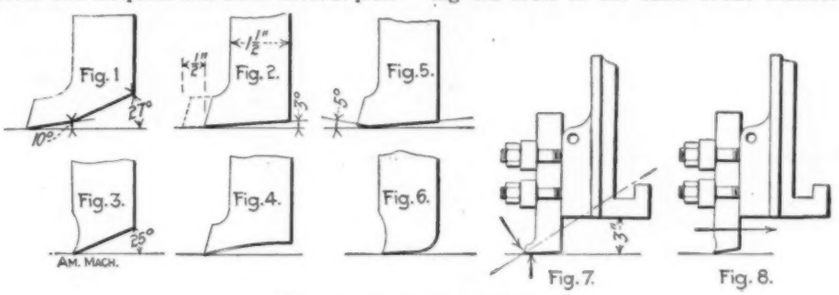
Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Details of Planer Tools

In a large manufacturing establishment employing many planers, an attempt was made, in the course of a scientific-management campaign, to change the detail of all planer tools. The detail specified was of Fig. 1, the tool being forged with an excessive clearance at the heel and the cutting-edge clearance ground back about ½ in. to an angle approximating 10 deg. It seems ridiculous and unthinkable that such a detail could be specified.

The expected occurred, breakage of tools was frequent and after several planers were wrecked, the entire detail of planer-tool supervision was abandoned and the planer men all drifted back to where they were before the advent of the efficiency engineer.



DETAILS OF CUTTING TOOLS

The source of all trouble was in not properly grinding the tools in the first place; the tool lacked support, and would dig in, thus wrecking the planer, not because it stood out so far beyond the apron, but because it lacked the proper supporting angle to give stability to the nose of the tool.

The planer tool should have an exact minimum angle of clearance, ground or shaped with the same care bestowed on milling cutters; when first ground and before being issued ⅜ in. should be cut off the nose.

The proper detail of tool is seen in Fig. 2. This tool is of an exact angle of clearance. In regrinding it the machinist should be cautioned not to alter this angle of clearance. This point should be rigidly enforced. The wear should be ground off the top of the tool for cutting rake only. The efficiency of the tool would be greater were the machinist provided with a simple gage to give a proper rake in grinding.

The tool, Fig. 2, will take all the belt will pull and come back for more without any danger of digging in or attempting to run through the table. These details are supported on heavy-duty planers, the crossrail adjusted two to three inches above the work, Fig. 7.

An analysis of the results of tool thrusts shows that with the downward thrust of the chip on the nose of the tool balanced by an exact angle of clearance, the opposing resistance lies along axis *O*, running near the center line of the crossrail supports, thereby giving the greatest possible stability and showing the highest efficiency of the machine tool.

In many shops the workmen are grinding the tools in the same crude manner of a half century ago. Figs. 3, 4, 5 and 6 show details of grinding noted lately in large machine shops, even after the so called efficiency engineer had taken hold. Fig. 3 is the heel of Fig. 1 that in some strange manner was saved. It will take a nice, smooth, light chip with tight gibs, but used in the side heads of a planer it would surely pull the work off the table.

A much better tool and the standby of old and experienced machinist is seen in Fig. 4. By stoning the edge of the clearance he had a tool that could be depended upon but costly to maintain. Fig. 5 shows that with minute examination a very decided negative clearance can be detected on many tools ground on coarse emery wheels. This results in decreased efficiency both in man and machine, and a vast increase of power. Scores of such faulty tools can be found in many large machine shops even this day.

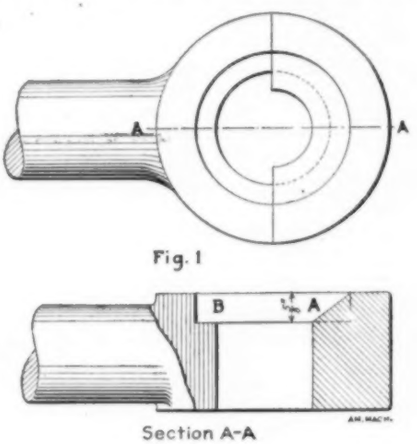
The instability of a tool of excessive clearance is illustrated in Fig. 8. This results in causing twisting strains to slides and crossrail. One peculiarity noted is that the tool slide, Fig. 7, being in state of exact equilibrium emphasizes why that tool should have exact angles, for under a heavy chip a small force on the crossfeed handle would cause the tool slide to move. For this reason the slide must be in good condition and properly adjusted. Fig. 8 shows that with the tool under a heavy chip severe twisting strains result.

Brighton, Mass. J. SMITH.

A Counterboring Method

The illustration shows one end of a locomotive spring-hanger which was to be drilled and counterbored as shown by vertical ruling section in Fig. 2.

Our largest counterbore pilot was only ⅞ in., and a bushing could not be used, because we would have to drill and tap a hole in the end of the pilot to hold the bushing in place. Again, if we drilled a ⅞-in. hole and tried to finish the job from that, it would leave too heavy a cut, and only the lightest feed could be used.



A COUNTERBORING METHOD

The cross-section at *A* shows our solution. The ⅞-in. hole was drilled through, and a 2-in. drill run down ⅝ in.; then the counterbore was used, after which the hole was enlarged to 1¼ in. This method, of course, leaves only the portion shown dotted in *A*, Fig. 1, to be removed by the counterbore.

Danville, Ill. C. H. DEANE.

A Natural Oil Filter

A perfect oil filter is a thing which is still to be perfected. A curious coincidence was recently called to my attention, in regard to the filtering of once used oil.

In a certain ball-bearing factory there is a practice of putting the much used oil from the ball grinders in barrels placed

in the open at the rear of the shop. This oil is full of dirt, emery and steel. Recently, after a heavy snow storm, one of the employees noticed that the oil was exceptionally light colored. Upon investigation, it was found that the oil had filtered upward through the layer of snow. The result was that it was as clear as amber. The fact that there was an absolute absence of any foreign matter, when it was previously full of it, it interesting, to say the least.

S. VICTOR BROOK.

Middletown, Conn.

Spherical Turning and Boring Device for Engine Lathes

A spherical turning and boring arrangement suitable for ordinary engine lathes is shown in Figs. 1 and 2.

The bearing bush, after being bored, is clamped upon a mandrel as shown in Fig. 1. The compound slide-rest is replaced by the plate *A* which is bolted to the main slide, but is allowed to swivel upon the same pin the compound rest is registered upon. This pin is now placed directly in line with the centers of the lathe. A simple method of doing this is as follows:

Place a mandrel, the same diameter as the pin, in between the centers; take a large square and when each side of the pin is coincident with each side of the mandrel the pin is in line with the centers. Then bolt the compound rest to plate *A* as far back as the diameter of the bush requires.

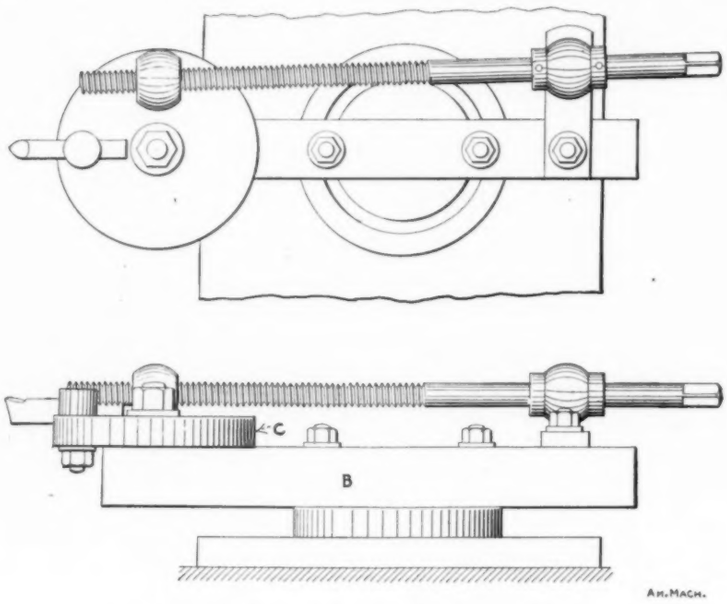


FIG. 2. SHOWING METHOD OF MACHINING SEAT

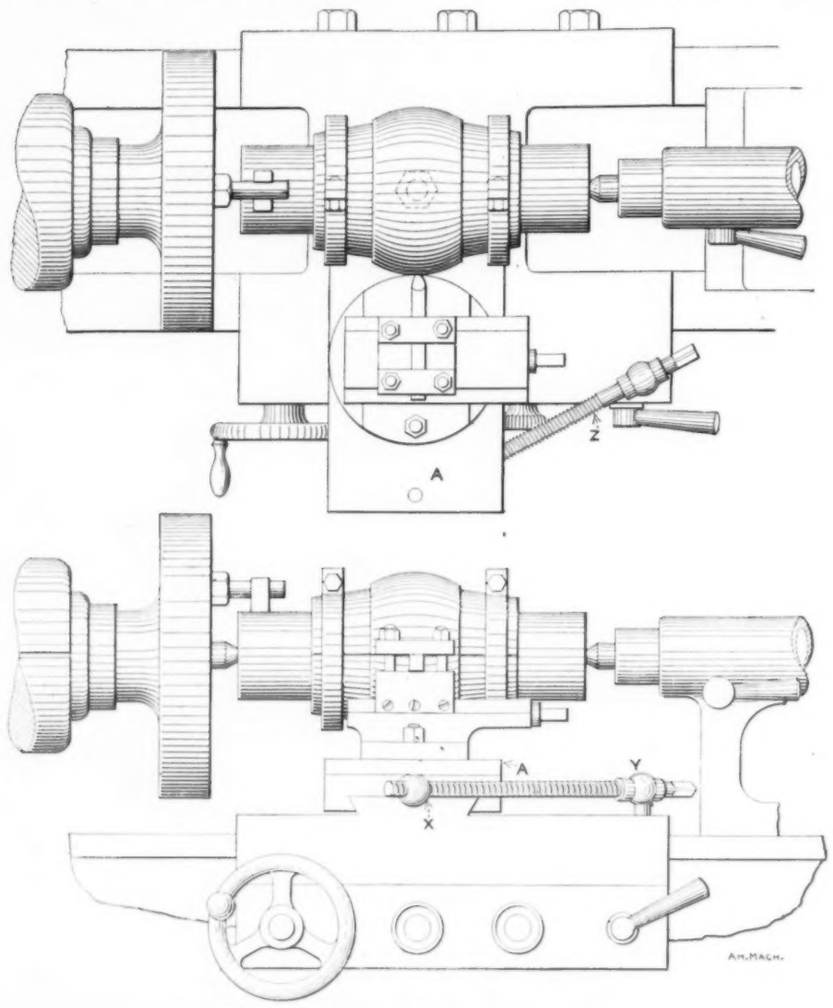


FIG. 1. BEARING BUSH CHANGED ON MANDREL

The tool must now be set level with the center height of the lathe. Plate *A* is drawn through the arc which it describes by the screw *Z* and the nut *X*, the pillar *Y* preventing lateral motion of the screw.

The plate *C* revolves on bar *B*, Fig. 2, and is operated by the same screw, nuts, etc., taken from the gear shown in Fig. 1. The seat for the bearing to be spherically machined, is bolted to the faceplate of the lathe, care being taken to set the tool in the disk *C* the correct center height.

This gear is economical both in initial cost and speed of production. A bush 6½-in. bore and 14 in. diameter of sphere and the pedestal and cap to hold it have been machined complete by this tackle in 12 hours, the total weight of the pedestal and bush being 8 cwt.

R. W. WHITTLE

Birmingham, Eng.

New Applications for Standard Material

There is a material not as well known as it deserves to be in the machinists' trade, which has applications quite apart from the uses for which it is manufactured.

It is known as Latten brass, and is used among other things for ruling pens, in machines, to rule either faint or red lines. In fact, the whole of the ruling of foolscap paper or account books in the printing trade, is performed by pens made of this material.

Latten brass is supplied in coils about 3 in. wide, and its thickness varies from

0.002 in. to 0.006 in., the usual thickness for ruling pens being 0.004 in. It is supplied in varying tempers from quite soft to a quality which crackles sharply when shaken.

My first experience with its possibilities was when running a large marine engine. We used it for fine adjustment liners cut out like paper liners for bearings and running gear. It was so easy to take up 0.002 or even 0.001 in. on bottom ends and main bearings by having a suitable assortment of thicknesses; taking out an 0.006-in. liner and replacing it with an 0.005-in. liner gave us an exact adjustment in the shortest space of time.

Asbestos card or millboard is a splendid material for broad surface joints, such as cylinder covers. Its drawback, however, is that a new joint is required each time the cover is lifted. A new joint for a 72-in. cylinder is expensive with this material. Using Latten brass to cover the asbestos millboard enables the joint to be broken time after time without making a new one necessary.

In three years one particular cover under my charge was lifted 20 times, and the joint was perfectly good still. All that was needed was just a little swabbing with cylinder oil. The Latten brass was cut just as far as it would go round, and the next piece just lapped over; the elasticity of the asbestos and the thin nature of the material permitting this.

I have used this same material in lining guide bars and packing up dies. In the case of sectional dies, where the sections are made with a liner of this material between each, it should prove very easy to adjust the sections for wear. As a packing it is absolutely solid.

Another material which I have successfully used for purposes other than originally intended is brass rule. This is $^{29}/_{32}$ in. in width and is in 24-in. lengths. This material can also be obtained in varying thicknesses, the usual range being 4, 6, 8, 10, 12 and 16 to a pica—a pica being ⅙ of an inch. The decimal equivalents can thus easily be calculated. It is spring brass in temper and is easily procured from the same sources as the Latten brass. Since the introduction of the point system in type-founding, it is sold under the point designation. Twelve points make a pica. A point is $^{1}/_{72}$ inch.

Used as a packing for purposes where thicker materials than Latten brass is required, and where its size is suitable, it is ideal. Its two edges are absolutely straight and parallel and its thickness is exact. It is the form in which really first-rate spring-temper sheet brass is the most easily procured. For drawing purposes a piece soldered onto a block of it makes a very handy small T-square. It should also be very useful to graduate for special feed and speed slide rules.

London, England. A. L. HAAS.

A Milling Fixture

A milling fixture which is almost continuous in operation, is shown in Fig. 1. Fig. 2 shows the work, which is a piece of brass turned and cut off in the screw machine. The fixture is for milling the spline *A*.

The device has a hole from end to end the size of the work, a finished piece of which is shown protruding from this hole at *A*. A plunger *B* works in the other end of this hole and is actuated by the lever *C*, which does the feeding. The plunger *B* is of such length that when the lever is thrown to the right, the end of the plunger moves to the right of the opening in the bottom of the feed chute *D*. The cutter rotates in the opening *E*, and is set central with the hole for the work.

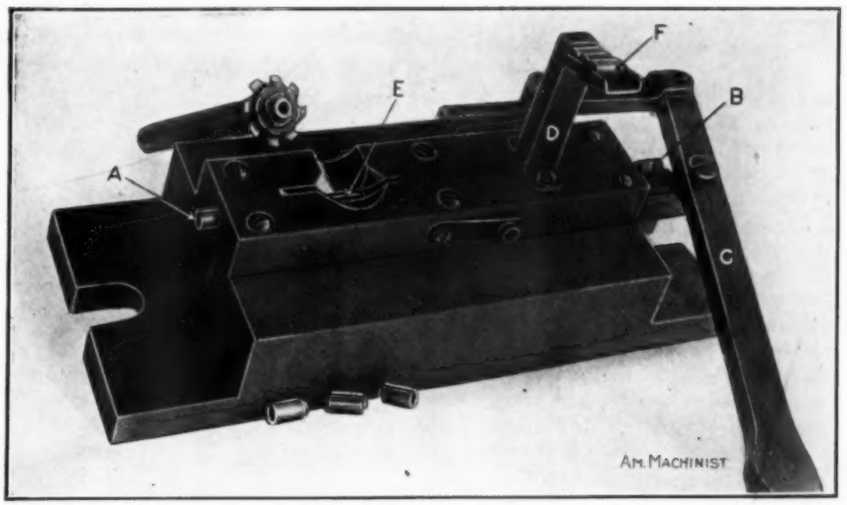


FIG. 1. THE MILLING FIXTURE

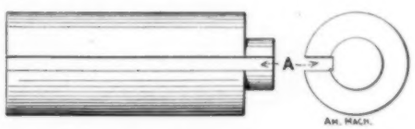


FIG. 2. THE WORK

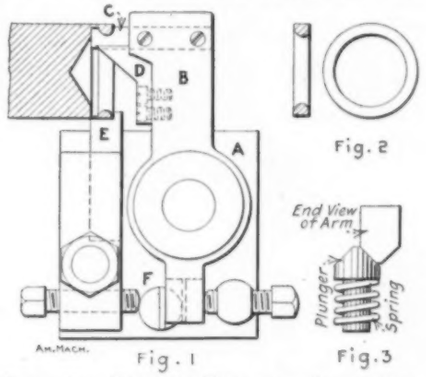
The operation is as follows: The operator fills the chute *D* and the small hopper *F*. The lever *C* is then worked until the hole is filled with work, as at each successive movement of the lever *C* to the right, another blank drops into the hole below, and at each successive movement of the lever *C* to the left, the pieces in the hole are fed toward the cutter rotating in *E*.

The operation of cutting is very rapid, probably not over a second or two for each piece. The pieces, when finished, pass along and drop out at *A*. In making a fixture of this description, the work must be a snug sliding fit for the hole. This fixture is in use in the works of the American Telegraphone Co., Springfield, Mass.

New York, N. Y. E. A. DIXIE.

Internal Forming Tool for Automatic Screw Machine

The sketches show an internal forming tool, which is used on a 2-in., 5-hole turret Cleveland automatic screw machine. This tool is clamped on the cross-slide of the machine, and consists of a block or base *A*, on which is mounted the swinging arm *B*, which holds the internal cutter *C*. As this tool is drawn to the work by the movement of the cross-slide, the swinging arm is hit by a bumper in the turret, which swings the tool in position for the operation, as shown in Fig. 1.



INTERNAL FORMING TOOL FOR AUTOMATIC

The backward movement of the cross-slide draws cam *D* against the edge of the finished hole, which action forces arm *B* to the right until it passes over the center of plunger *F*, which sets it against the stop-screw in position to clear the stock at the start of the next operation.

Fig. 2 shows the finished collar. Attached to block *A* is a rest for holding cutter *E*, which turns the outside diameter of the stock while the internal tool is cutting, thus completing two operations at once. Fig. 3 is a view of the rear end of the swinging arm and plunger.

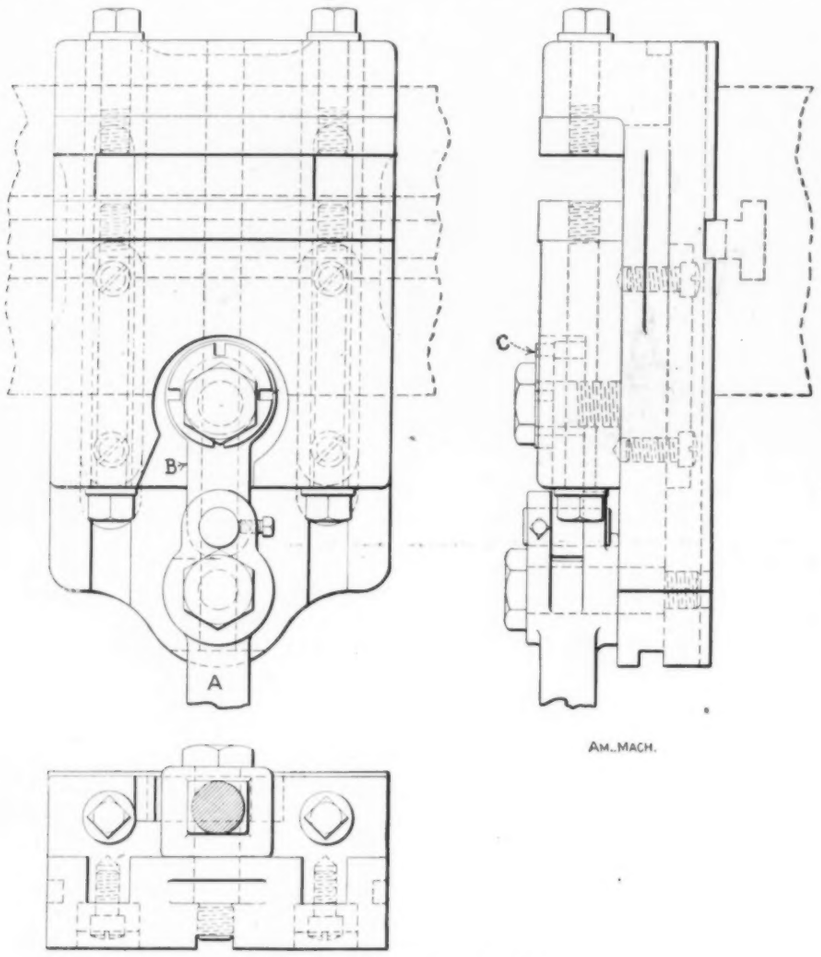
FRED HUNDORF.

Cincinnati, Ohio.

A Quick Acting Miller Vise

The cut shows a quick-operating toggle vise for manufacturing purposes with jaws that opened at least ¼ in. to hold and properly locate a forging.

Instead of using an eccentric I used the toggle lever, *A* and link *B*, which is concaved for the purpose of springing enough to allow the lever to pull up to



A Quick-acting Miller Vise

stop or center, as the forgings varied about 0.02 in. in thickness.

The eccentric bushing detail *C* has ¼-in. throw for adjustment to take care of wearing or reduction of jaws. The vise has been in use for the past six months and is giving quite satisfactory results.

Flint, Mich. G. W. Ellis.

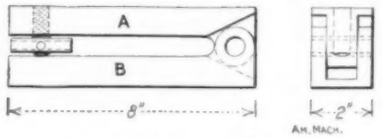
Tilting Packing Blocks

There are many jobs on the toolroom inspection slab, or laying-off table, which it is necessary to tilt either for the purpose of examination or lining off. Where there is no tilting plate, the usual procedure is to pack the work with wedges, pieces of paper, etc. Frequently it is necessary to pack up at some other point and then the first setting is thrown out of alignment and has to be reset.

The tilting packing blocks shown in the figure obviate the necessity of loose packings and will be found extremely useful in cases where the orthodox, screw raising blocks cannot be used.

Referring to the cut it will be seen that as the two halves of the block *A* and *B* are hinged together, part *A* will be tilted if the screw is turned.

For lining off jigs with the base at an angle; and for castings generally, these blocks have advantages over the tilting table, inasmuch that each end of the



Tilting Packing Blocks

jig can be tilted to suit the irregularities of the casting.

Walter G. Groocock.

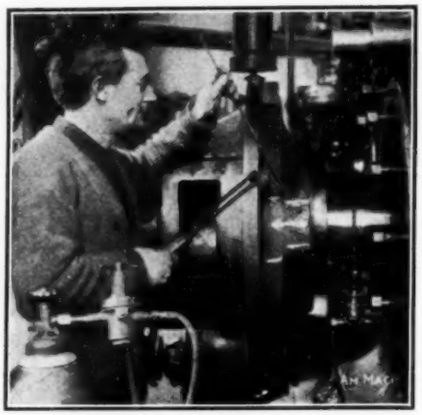
Plumstead, England.

Oxyacetylene Welding a Pinion Shaft

Repairs recently made to one of our producer-gas engines show the possibilities of the oxyacetylene flame.

This engine, a three-cylinder vertical, 16x18 in., running at 257 r.p.m., while under load stripped the teeth on the crankshaft gear, and also the next gear on the intermediate shaft that carries the pinion driving the inlet and exhaust camshafts.

Evidently some of the broken teeth got wedged between the two gears, crowding the pinionshaft so hard that it was badly sprung. The springing of this short shaft caused the bearing which is on the main bearing housing to crack in three places



Welding a Pinion Shaft

for a length of about 4 in. At the extremities the cracks were open about ⅛ in. To repair this and get the engine back in service was the problem. An oxyacetylene welding company in a neighboring town was notified.

This company's operator began his work at 7 p.m., and at 10 p.m. had the work completed. Two cracks were welded at first, both being done in about 40 min. A rest of about 30 min. was taken by the operator and the final crack welded.

The illustration gives a good idea of the nature of the cracks and of the apparatus used. The housing contained the babbitt linings of the main crankshaft, but at no time was there any dangerous heat near the babbitt. The welds were carefully watched while cooling for shrinkage strains, but no trouble was met, and to all appearances the casting is as strong as ever.

The white marks near the burner show the location of the cracks. The center crack was about ¾ in. in depth and about 1¼ in. in the other two.

Keene, N. H. Homer J. White.

According to a recent bulletin, published by the Bureau of Mines, some of the products of natural gas which are now going to waste could be compressed into containers and could be handled as gases. The process has been developed for other gas industries, but its promise as a profitable commercial enterprise in connection with the development of the new product has only recently been recognized.

The Pattern Maker and the Coreroom

By Jabez Nall

A practical discussion of the relation of coreroom practice and patternmaker. Some illustrations of how the latter's ignorance of coreroom methods results in improperly constructed core-boxes, and faulty castings.

A knowledge of coreroom methods and practice, and of the detail work to be performed in the construction of cores is evidently considered by many pattern makers as something beyond their sphere, something that does not concern them in the least, or, as one pattern maker said (after making a core box from which it was impossible to get the core out whole) in reply to the query of his foreman, as to how he was going to get this core out of the box: "Oh, that's none of my business; that's the core maker's business." In a measure, at least, what is the core maker's business is also the pattern maker's business, and the same is true of the molder also.

In the production of castings, the three trades of pattern making, core making and molding are intimately associated, and as in the sequence of the work, the pattern maker comes first, and because of the fact that he must provide a part of the tools by which the work of molding and core making is done, it is necessary that he should have a knowledge of how these tools are to be used, and the more familiar he is with the details of the work to be done, the better the result will be. Improperly designed or misconstructed core boxes may be, and are, the cause of much loss of time in the coreroom. A few illustrations of this fact will be discussed further on.

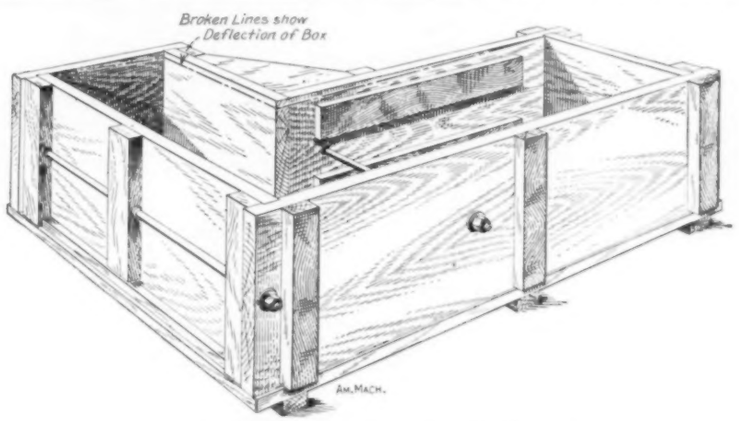


FIG. 1. METHOD OF REINFORCING CORE BOX

WHY THE PATTERN MAKER SHOULD BE POSTED

It is especially necessary at this time that the pattern maker keep in touch with the change in coreroom methods that is going on today; these in some shops amount almost to a revolution. Since the advent and perfection of the automobile and the smaller gas engines, and the fact that the machine designer is giving more thought to coreroom equipment for the betterment and perfection of core production, it is doubly advisable for him to keep posted, as this leads to new methods, which may call for special arrangement of the core boxes to facilitate the work.

The time was, when the coreroom was the most neglected of all departments of the foundry, and all you expected to find there was a heap of sand in one corner and in another corner a pile of crooked core rods very much entangled. When it was necessary to straighten or cut off any of these, the core maker found it necessary to climb on top of the pile, disentangle enough to get at the one wanted, and then by the judicious use of a hole in a core plate it was possible for him to straighten or bend it to the shape required. Cutting off the rail on which the car ran in and out of the oven, made the best substitute for an anvil, and two or three men were needed to accomplish the job; much depending on the size of the rod. The only means of ramming was contained in a few discarded rammers from the foundry, and perhaps some cast-iron hammers with most anything for handles.

These are a few details of fact, depicting actual conditions in corerooms, in which the rest of the equipment was of similar antiquity, even to the old hand-power, wooden-frame jib crane, by which the heavy cores were placed on a car almost as high as the core itself. In many cases it was necessary to make the heaviest cores upon the car, as otherwise it would have been impossible to load them on. This emphasizes the fact that the pattern maker must be familiar with the details of the work to be performed, in order that he can so arrange the box as to avoid the necessity of rolling over the core, thereby saving much hard labor.

MODERN EQUIPMENT

Conditions are altogether different in the modern coreroom. Now we expect to find not only mechanical sifters and batch mixers, but some form of conveyor also for the sand. A rod straightener with shear attachment does away with the tangled heap of rods, and makes them not only available but in shape for use. In addition to the air hammer, there may be any sized jarring machine from the foot-power bench machine, making special-shaped cores of a few ounces in weight to the jolt machines, whose capacity is reckoned by the ton. The core machine for round cores is a necessity, and no progressive coreroom handling heavy work is without its overhead crane. As the molding machine in the past few years has made many changes necessary in the making and construction of patterns, so today the change of equipment and the application of machinery as a solution of the core-making problem does, and will require many changes in the arrangement and construction of core boxes, not only in shape but in material; and the pattern maker best posted on these is the one who will win out in the end.

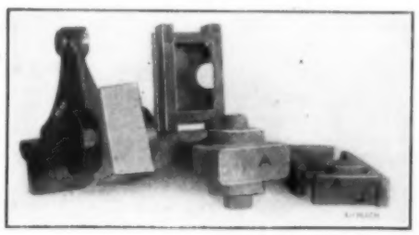


FIG. 2. A POORLY CONSTRUCTED CORE BOX

These are a few reasons why he should make a study of this subject for himself. Not many pattern makers get the chance to learn these things by observation, and their only recourse is in the discussion of these subjects in the trade publications.

THE RELATION OF CORES AND FITS

One of the chief causes of trouble between the pattern shop, coreroom and foundry, is what may be termed the relation of cores and fits. If, by discussing this subject and seeking for cause and effect, we can arrive at a point where the molder can be given an absolute divorce from the idea that each core must

be given a liberal application of the file or rasp, before trying to place it in the mold; if we can give him a reasonable assurance that each core will reach the place intended for it, without destroying his previous work by crushing or tearing the mold in its passage; if the two faces of core and mold can be kept intact and smooth, and thus do away with the cause of many dirty molds, and subsequent defective castings; if we can eradicate from the molder's list of tools the rasp and the firebrick when used for this purpose, we will have made one step at least in the direction of economy, and the production of perfect castings, and will have solved the problem of cores and fits. If we can set a standard of allowance to be made for the swelling of the core and of the mold in case of skin-dried or dry-sand molds, we will have simplified the problem for others.

If there is one thing more than another that the average pattern maker is proud of, and rightly so, it is his ability to produce a well finished pattern, accurate in dimension and true to the drawing from

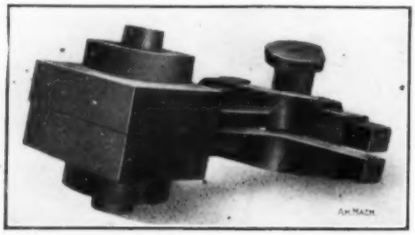


FIG. 3. PRACTICAL CONSTRUCTION OF PITMAN PATTERN

which it was made. In other words, his ability to work close to a line is a good feature and one of the necessary qualifications of the good pattern maker. A difference of opinion often arises between pattern makers as to the correct placing of the lines. It is difficult to convince some of the necessity of allowing for clearance in placing the core in its "print." The argument will likely follow that this was not the practice in other shops, and because the box measures the same as the print, to a hair, then it must be correct. Probaby the pattern maker arguing thus had previously been employed on a very small class of work, where it is both practical and necessary to make these close fits in the mold, but to apply this method to larger work is neither necessary nor practical. If such a pattern maker could be taken into the foundry and shown the molder correcting his fine measurements with a brick, maybe the conviction that he was wrong could be made to stick.

SOME REASONS FOR MISFITS

Anyone having held the onerous position of "checker" in the pattern shop, could tell of the numerous arguments; some amusing, some otherwise, on this question. It is amusing sometimes to note the variety of reasons that can be given to explain why certain measurements are too large or too small. Take a 20-in. ring core box for instance, that gets too large in the lathe, from the effort to cover up carelessness in building, or the fact that more was taken off than was intended. The checker points out the fact that the core box is $\frac{1}{16}$ in. larger in diameter than the print, whereas it should be $\frac{1}{4}$ in. smaller. "Oh well," he says, "that $\frac{1}{16}$ in. is draft, and the core maker will rap the box and that will make the core smaller, and the molder will rap the pattern and that will make the imprint larger and the core will go in easy." Will it? With a green-sand mold even after all the rapping has been done, it is difficult to reprint a pattern that is of any size in the mold it was taken out of. With a dry-sand mold, it is an impossibility.

Sand to sand does not make a very good gliding fit, either green or dry, and this you remind him is for a steel casting, the mold for which, as well as the core, must be dried, core and mold both swelling to some extent, and acting one against the other, the imprint in the mold getting smaller and the core larger.

If the pattern maker is not to make his core boxes the size of the print, he is justified in asking how much smaller they should be made. Some advocate the making of the pattern to shrinkage rule and the boxes to standard rule, but this it seems does not give the best results. It would probably be sufficiently correct for small or medium-sized cores, but it has its limitations. For large cores it would be too great an allowance, and this would affect the dimensions of the castings in vital parts.

There is the necessity also for a greater allowance in the print parts of the core for clearance than is required anywhere else. The molder says, "better a fin than a crush." This may be so, but it is still better that the fin be a light one, allowed for by the pattern maker, than the result of the molder's exertions in filing the core.

Another point that enters into the discussion is the difference in coreroom practice that gives such different results in the size of cores. Some will vary so little from the size of the box as to be unnoticeable, others have been known to be as much as $\frac{1}{4}$ to $\frac{3}{8}$ in. in 30 in. larger than the box, cores made from the same box varying an amount equaling that. In such a case, the remedy must lie with the coreroom practice—in the material, mixing, ramming or baking of the core—the temperature at which the latter is done being an important factor.

UNIFORM RESULTS FROM FAMILIARITY

With uniform results in coreroom practice, or if the pattern maker is familiar with the practice of the foundry that is to make the castings from the patterns he is making, and will give this point proper consideration, good results can be obtained. Two steel castings were recently made from new patterns weighing, respectively, 16,000 and 17,500 lb., the mold for each containing some 25 cores, small and large; these 50 cores fitted in their places without trouble until about the last core of the second mold. This was a core approximately 10x12x16 in. in size, and, having a tapered print, was the least expected to cause trouble, but it got within 2 in. of reaching its place and stuck. On taking out, of course, the usual damage both to core and mold resulted. On investigating the reason for this, it was found that the pattern maker responsible for the core box, though instructed to allow $\frac{1}{8}$ in. on all vertical print surfaces for clearance and probable

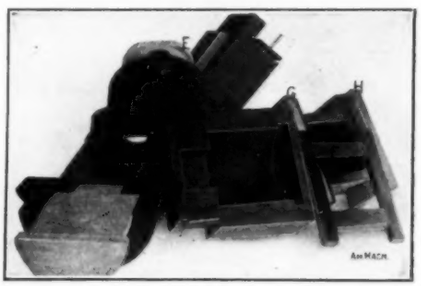


FIG. 4. PATTERN FOR CASTING HAVING HOLE CORED IN THE END

swelling of the core, had allowed but $\frac{1}{8}$ in. over all, or for two opposite surfaces, and hence the trouble. These cores varied in size from the smallest, 2x4x3 in., to the largest, approximately 22 in. deep by 3 ft. wide by $6\frac{1}{4}$ in. long.

The smaller cores were made with an average shrinkage allowance of about $\frac{1}{8}$in. over all. Cores 12 to 24 in. with $\frac{1}{8}$ in. on all vertical print surfaces and surfaces abutting other cores; others varied in amounts to the largest where an allowance of $\frac{1}{4}$ in. on all such surfaces was made, all core boxes being made correct as to depth. For all other dimensions, the same shrinkage rule was used to which the pattern was made.

The result was very satisfactory, many of the cores fitting as tight as practical, the fins being very light and the cost of chipping and cleaning the castings was reduced to a minimum, the castings finishing up in the machine shop correct as to all centers, and with clean surfaces.

For the making of perfect castings, it is up to the pattern maker to provide the necessary clearance for the cores abutting

each other and to enter the print freely. Of course, with the cores in place, the closer the fit and the better the job; but he should bear in mind that two sand bodies after handling and baking cannot be expected to come together as close as the two pieces of wood he has prepared for a glue joint; little irregularities will occur to prevent this, especially when the cores are large. As for the prints, wherever possible a generous taper should be given to all vertical surfaces, as this will allow for easy drawing of the pattern with closer measurements and a better fit of the core.

In this discussion, only the regular run of work to be found in the foundry that stands ready to produce anything within its capacity is being considered. Repetition work, when made in large quantities, must, and, of course, will, be taken care of, and inaccuracies corrected or prevented. Not all classes of work, however—such as is met with in the regular jobbing foundry—will bear the expense of duplicate drying and other appliances that lead to perfection in this line of work. This suggests another reason for the change of size and shape of the cores, and the very frequent cause of misfits in the mold; this is the warped core plate.

Warped Core Plates

In using a warped core plate, the usual method is to throw on top of the core a quantity of "black" or molding sand as a bedding for the plate, giving a few taps with a sledge on the top or back of the plate to help make it solid. This compresses the sand hard at the points of contact only, leaving the rest of it soft. The plate is then clamped tight to the framework of the box at its outer edge, thus springing the plate. After the core is rolled over and the clamps are released, the plate retaining sufficient elasticity returns to its former position, and the core settles on this, with the result that the core nearly conforms to the warpage of the plate.

A straight plate, improperly placed on the car for drying, may warp in the oven, with a like result as to the core, which, while moist, will follow the plate. Another very frequent cause of distortion and change in size of cores is the sagging of the bottom board of the core box while ramming.

While it is true that many core boxes are made of lumber too light to support the weight of this material and the ramming of the core, this condition could be profitably changed. Still in the case of large boxes, to do so altogether would add unduly to the lumber bill, and the weight of the box. The reinforcement of the outer framework of the box, by proper bracing or by bolts passing through the core, is a simple proposition, but as most corerooms have uneven floors, it is up to the core maker to provide a level and solid foundation to support the bottom board, particularly at the center, and thus avoid sagging.

Reinforcing a Core Box

The reinforcement of core boxes by bolts passing through the core to prevent the spreading of the box while ramming, suggests itself as another reason for misfitting of cores, and recalls an incident that came under observation. A core box in form as shown in Fig. 1, was in more or less constant use, cores and casting coming out well for some time, until one day complaint came from the machine shop that they had two castings in which the cored sides for slide were not parallel, there being a difference in 40 in. of ¾ in., taking away the whole of the facing strip at one end and cutting into the wall of the casting. It was obvious that the reason for this was in the bolting up of the box before making the core. Remonstrating with the core maker evoked the reply that all he did was to pull the box up tight. Afterward distance pieces to lay alongside of the bolt were supplied, these being correct in length according to the inside width of the box. Their use stopped all further trouble.

As suggested in the beginning, improperly designed or misconstructed core boxes are the cause of much loss of time in the coreroom. In Fig. 2 is shown a simple example of this, that illustrates a principle. *A* shows an old pattern for a pitman, the core print being numbered to correspond with the core box *A* at the right. That this is not an altogether impractical method is proved by the appearance of both core box and pattern, but the distinction is made that it does not represent the best practice in such a case.

This box, made loose at opposite corners, requires to be clamped together in some form. This is usually done by the use of "dogs," and results in the damage noted at *XX*. The core box *B* shows a similar core, but represents a better practice. In this case the core print is beveled on three sides, and the box is what is termed a "dump" box, being made solid. This box is fully as cheap to make in the pattern shop and the core can be made from this while *A* is being clamped together.

Another point in modern coreroom practice is that *B* can be readily combined with other small boxes for use on a foot-power or other jarring machine, while with the core box *A* this is impractical.

In Fig. 3, is shown a more practical method of constructing a pitman pattern similar to *A*. In this case the pattern is split, and thus can be used as a single pattern, as shown, for hand molding. If ordered in sufficient quantities, it can readily be placed on match boards for machine molding. It will be noted that the cope half of print overhangs the drag; this overhang is ⅛ in. While this practice is not uncommon, still it is a point not always borne in mind by the pattern maker that when necessary to close over the top of a square core (this core being made from a "dump" box the full depth of the combined print), either he must provide clearance for this, or the molder must provide it by shaving his mold, or it must be done by filing the upper part of the core. The simplest, best, most economical and effective method is the one shown, and particularly so for machine molding.

In Fig. 4, at *D*, is shown a pattern for a casting having a hole cored in the end in the form shown, this hole having a finished depth. It is common practice in such a case to run out a straight round print sufficient to balance the core if a plain hole, or if special, as in this case, with some form of "telltale" on the print. This practice was not objectionable until a few castings were made defective, by the molder placing the core away from the end of the print, and thus making the hole too deep in the casting. Since then, in all such cases, a collar is placed on the print as at *E*, and the core box constructed accordingly, as shown.

A pattern, for which it is necessary to "hang" the core from the cope, is shown at *F*. This is one of those little things that save time and help the core maker to meet the efficiency test required today of all mechanics. The print for this core having beveled edges, required the box to be parted at the joint of the pattern and core print, the frame for the latter being constructed as shown. Ordinarily the pattern maker considers the box completed when this is made and doweled in place.

With the core rammed up, this frame must be removed before rolling over, leaving the sand standing above the remainder of the box. To lay the plate on this and roll over is risky, but all risk and danger of crushing the core is avoided if the two additional side pieces *GH* are added to support the plate.

These are small things and to some may seem insignificant, but the day's work is made up of little things, which, in the aggregate, cease to be small.

A gear with a few teeth stripped off was brought for repair to a small shop with a Canadian foreman. The machinist assigned to the job was a recently landed German. Said the foreman:

"Fritz, I want you to fix this gear. I think we had better put in a 'Dutchman' ".

The German's ears went back and his hair bristled. "Say," he said, "I dink ve put in a 'Canuck,' ain't it."

Larger Tool Builders' Association

By D. M. Wright*

A suggestion to enlarge the Machine Tool Builders' Association by taking in as members all manufacturers of metal-working machines. Several advantages that would come from this course are pointed out.

*Secretary and treasurer of the Henry & Wright Manufacturing Co.

At the recent hearings given to machinery manufacturers, before the Senate Finance Committee, in Washington, in opposition to that portion of the Underwood Bill which proposes to put the so called machine tools on the free list, the testimony showed that the courts had decided that practically every kind of a machine that employed a tool was just as much entitled to the name machine tool as any of the machines commonly so called.

It was also shown by the testimony of the manufacturers that they did not know what a so called machine tool was, and that their machines were variously called tools, machine tools, tool machines, machines and metal-working machines. It was very clear to those in attendance that this misunderstanding was general and had a great deal to do with the appearance of the obnoxious clause in the bill. If the makers of machinery do not know how to describe their product, how should they expect the law makers, the customs officers, foreigners, or the public in general to have any clearer ideas on the subject?

It may be quite possible in many cases to have machinery entered under the most favorable classification, and possibly this may be a partial reason for the report that only two hundred thousand dollars worth of so called machine tools were imported and nearly ten million dollars worth of machinery exported.

When the confusion of ideas of what constitutes a machine tool is considered, it becomes easy to understand the lack of importance given to the imports as against the exports. When it is further considered that the testimony showed that, owing to the advanced systems of industrial education prevailing in Germany, in conjunction with a wage scale 50 per cent. lower than in America, we would be unable to cope with German competition if the duty was removed, as contemplated by the Underwood Bill, a striking instance is presented of the danger and folly of persisting in the use of meaningless, untranslatable and inaccurate language. This should prove a decided spur to the committees and individuals working to clarify mechanical names.

At first thought, the accomplishment of the work seems like a tremendous undertaking, but if its actual, practical importance is once recognized, the members of the mechanical engineering profession should be too intelligent to persistently stand in their own light, when even a slight effort will produce rapid results.

It is first necessary to revert to plain English, using, as far as possible, words of single meaning and the clearest descriptive character, and dropping all words of no known derivation, and of complex and untranslatable meaning. Only the simplest, clearest and most easily translated words that the English language affords should be used.

The nature of the language used by the mechanical-engineering profession is responsible, in a large measure, for the inadequate definitions which appear in the standard dictionaries. It therefore becomes necessary to adopt a clear definition for both machinery and tools in order to make an intelligent start. The following is offered, subject to criticism, for adoption until better definitions are found.

Definitions of "Machine" and "Tool"

"A machine is an automatic transformer of energy."

"A tool is an implement to work with."

If these definitions are accepted, it is clear that a machine is not a tool, nor a tool a machine, and they should never be confounded. All kinds of machinery may then be classified under the general head "Machinery," with as many subdivisions as desired in order to clearly describe the work which the machines in question are designed to perform. Thus, so called machine tools become metal-working machines, and other machines, wood-working, leather-working, stone-working, etc., and machines to produce a finished product, may very well be named after their product, as nail machines, screw machines, pin machines, etc.

The choice of words of single meaning is illustrated by the common use of the word "upright," a word of double meaning as against "vertical," a word of single meaning, and very distinct as against horizontal.

There are also the words "grinder," "miller," planer," "shaper," etc., used as names for machinery, whereas there is no recognized authority for their use as names for machinery only. They may be just as correctly translated to mean anyone or anything that grinds, mills, planes or shapes. There can be no excuse for minunderstanding or mistranslating the words "milling machine," "planing machine," "shaping machine," "grinding machine," etc.

Also, why should a vertical turning and boring machine be called a "mill"? It neither grinds nor crushes, but might easily be so understood by a translator. Again, if a horizontal turning machine may properly be called a "lathe," why may not a horizontal boring machine be called a slat? The connection is no more remote in one case than the other.

Brevity seems to be the principal reason for the use of "clipped" language, but this is not a safe stand to take, as otherwise the language of ignorance, which is generally brief, and often highly expressive, if not clearly translatable, would be generally adopted to the final exclusion of more refined language.

Enlarging the Scope of the Machine-tool Builders' Association

If the National Machine Tool Builders' Association were to officially adopt the suggested definition of a machine, it would result in a change in name, and a tremendous increase in the scope of its work and influence. Thus, the Association might become the National Metal-Working Machinery Makers' Association, and take in as members makers of any kind of metal-working machines, the particular work of sole interest to the makers of a single kind of machine being handled in committee without any deviation, except an extention of the present system.

As all employ the same kind of workers, and the matters discussed on the floor at the conventions are always of just as much interest to the makers of one kind of metal-working machines as another, no other result but good could come from such a change, and it would be a valuable recognition of the importance of properly naming machinery. Furthermore if the court decisions are to be recognized as authoritative, it is difficult to see how the Association can reasonably refuse to admit to membership any concern that makes any kind of a machine which uses a tool.

The changing of the name, however, would inply that its work was in the interest of makers of metal-working machines only. The confusion of understanding as to what constitutes a so called machine tool, has heretofore made it extremely difficult for the association to intelligently restrict its membership.

While there is sometimes fear in the minds of very conservative men that any enlargement may lead to unwieldiness, this fear is nearly always untenable. If the enthusiasm shown when any de-

(*Continued on* 565)

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.

505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

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Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.

Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1911, 1,358,200 copies. For March, 1912 (American weekly, American monthly, English weekly and German weekly), total, 91,250.

Of this issue, 27,750.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 225

American Machinist

Enlarging the Machine Tool Builders Association

In an article in this issue D. M. Wright advocates enlarging the membership of the association. He suggests definitions for the terms "machine" and "tool," and then says:

If the National Machine Tool Builders' Association was to adopt officially the suggested definition for the term machine, this action would result in a change of the name of the association, and bring about a tremendous increase in the scope of its work and influence. Thus the association might become the National Metal Working Machinery Makers' Association and take in as members the makers of any kind of metal-working machine. The particular work of sole interest to the makers of a single kind of machine could be handled in committee without any deviation from but merely with an extension of the present system. All members would still employ the same kind of workers, and the matters discussed on the floor at conventions are of as much interest to the makers of one kind of metal-working machine as to another.

No other result than good could come from such a change. It would be a valuable recognition of the importance of properly naming machinery.

If recent court decisions stand, it is difficult to see how the association can reasonably refuse to allow any concern to enter its membership provided that firm makes any kind of a machine which uses a tool. The changing of the name as suggested would imply that the work of the association was in the interests of the makers of metal-working machines only. Already on account of the confusion of understanding as to what constitutes a so called machine tool, it has been extremely difficult for the association to place a definite limit as to its membership.

While there is sometimes fear in the minds of conservative men that any enlargement may lead to unwieldiness, this fear is nearly always untenable. If the enthusiasm shown when any decided gain in membership is recorded is any token of their real feelings, the majority of the members are in favor of extension at least up to the limit of possible membership. There is absolutely no question that the association grows in importance to each individual with the growth of membership.

We understand that under the present acceptation of the meaning of the term "machine tool" the limit of possible membership has been nearly reached. The activities of the association are being increased, as shown by the recent appointment of a permanent secretary. The advisability of extending the membership is therefore a pertinent and important matter for the members to discuss.

In this connection, a few general facts may be worthy of mention, that members may consider at the same time the advantages of enlarging, as given above, and possible disadvantages from that course.

It is always somewhat hazardous to change the aims, purposes or fundamental rules of any society. If success has been had along a particular line, excellent reasons must exist for departing from that line. This is particularly true if the ideas of a large number of men must be harmonized as in the conduct of a society. Thus, an increase in size is often a hindrance instead of a help. The larger machine costs more to keep in motion, has greater inertia and may prove less efficient than its smaller predecessor.

The National Machine Tool Builders' Association is a business organization, and the tie that holds its members together may weaken if the membership is very much increased.

Again, with an enlarged membership may come temptations to take up other things; for instance, to take sides in labor controversies. This is now the peculiar field of the National Metal Trades Association, and there is no excuse for any other society to enter it. The technical field of machinery building is likewise covered by the natural activities of the American Society of Mechanical Engineers; that society is now energetically enlarging the scope of its work, and already has a special machine-shop committee.

The field that the association is now in is not covered by any other organization. A logical extension, if extension it could be called, would include all who have common business interests; that is, all who build machines used in making machinery.

The Use of Limit Gages

In spite of our boast about interchangeable manufacturing, there are still many shops which seem to have no idea regarding the degree of accuracy which it is possible to obtain commercially. There are still many places which insist that they have no limit of accuracy, but that everything must be exactly to the dimension given. Needless to say, in most cases, they have no means of measuring more closely than 0.010 in., and several times this error is allowable.

Then too, many of us always connect micrometers and accuracy as though this was the only way. While the micrometer is indispensable in many places, it has no place for inspection work, either from the standpoint of accuracy or time. This is not because of any defect in the micrometer, but because it introduces the possibility of the inspector making incorrect readings, and because it takes time to secure readings which are at all accurate.

We have known of the limit gage for many years, but there is a big difference between knowing a thing and making use of it. Limit gages are being used in altogether too few instances, and those who are not familiar with them in inspection work, in large plants, would hardly dream of the rapidity with which they can be used, and the work accurately gaged.

They entirely eliminate dependence on the delicate touch or feel of the operator, as every piece which is within the desired limit of accuracy, will go easily through the first pair of points, and will not go through the second or "not go" points. There is no reading to be done, and any operator can become so familiar with gages of this kind that many hundred pieces can be gaged per hour with a greater degree of accuracy than is possible with the micrometer, unless it be in the hands of an expert.

Limit gages are used much more extensively in England and Germany than in this country, and it is somewhat surprising to find that they have not been more extensively introduced in our manufacturing shops.

While they are somewhat costly to install, although there is likely to be a change in this respect in the introduction of comparatively low-priced limit gages. They can be freely used and compared as occasion demands with the more expensive standards kept in the toolroom.

In the matter of screw threads the limit gage seems to offer the only practical method of measuring on a commercial scale. The thread micrometer is an excellent instrument for occasional use, but is not to be considered for inspection work, owing to the time required for setting and reading and the possibility of error as in any other micrometer measurements.

It does not matter whether your working limit is in ten thousandths of an inch, or in thirty-seconds, limit gages provide the most practical method known in manufacturing today. This is equally true whether the work be rough turning in the lathe preparatory to grinding or the finest instrument making; the principle of limit gages holds good in both cases, and is well worth the attention of those who may not have considered its possibilities as applied to their own work.

Whether you make the gages yourself, of cast-iron or bent-up steel bars, or whether you purchase the most expensive outfit made, the principle of measuring by this method should be better known than it seems to be in most shops.

NEW PUBLICATIONS

PREVENTION OF RAILWAY ACCIDENTS. By George Bradshaw. 175 pages, 4½x6½ in. Norman W. Henley Co., New York. Price, 50c.

The author is a railroad man who has been impressed by the many preventable accidents, and endeavors to show the causes and the remedy.

Many of the accidents he attributes to the human element and shows by original photographs and drawings both the safe and the unsafe methods of work. These, together with concise suggestions and directions in such matters, should do much to aid in lessening the accidents which occur daily.

When we realize that our carelessness may endanger others as well as ourselves, we begin to appreciate the extent of individual responsibility. The book is well worth reading.

THE METALLURGY OF IRON AND STEEL. By Bradley Stoughton. 537 6x9-in. pages; illustrated; indexed. Second edition. McGraw-Hill Book Co., New York City. Price, $3, net.

This second edition of a well known work has been thoroughly revised and entirely reset. This has been occasioned by the improved practice in every department of manufacture, at least in minor respects, and in some branches by a considerable advance in the art, such as the duplex and special openhearth processes, electric smelting and refining, use of the dry blast, case-hardening and others.

The section on blast-furnace fuels has been taken from chapter II, rewritten and enlarged. With the section on openhearth fuels from chapter VI, it has been embodied in a new chapter XIX, on metallurgical fuels. The references to existing literature have, in accordance with several suggestions, been taken from the end of the individual chapters and collected in an appendix, thus rendering it easier to turn to the index numbers at will.

PERSONAL

William E. Choate, treasurer, Visible Addressing Machine Co., has been appointed general manager of the Carr Fastener Co., Boston, Mass.

F. H. Brown, who was formerly connected with the Strelinger Co., Detroit, Mich., is now with the W. P. Davis Machine Co., Rochester, N. Y.

J. M. Magnuson, formerly general foreman for the Henry E. Pridmore Co., Chicago, is now superintendent of the Livermore Foundry & Machine Co., Memphis, Tenn.

H. Morris, vice-president of the Western Tool and Manufacturing Co., Springfield, O., sailed on March 28 for an extended European trip in the interests of his company.

William H. Holland, formerly connected with the Sibley Machine Tool Co., South Bend, Ind., has succeeded Walter A. Sibley as president and general manager of that company.

Frank P. Judge, formerly head of the mechanical department of the Wells Bros. Co., Greenfield, Mass., has been appointed general superintendent of their gage and bolt cutter shops.

James W. Wilson, until recently connected with the New York office of the Westinghouse Machine Co., has accepted the position of factory manager of the Bramhall Deane Co., New York City.

H. H. White, who has in the past been in the employ of the L. S. Starrett Co. and the National Cash Register Co., is requested to acquaint us with his present whereabouts for the information of a mutual friend.

William H. Winterrowd, formerly assistant engineer of the mechanical department of the L. S. and M. S. Railway, Cleveland, O., has become mechanical engineer of the Damascus Brake Beam Co., Cleveland, O.

H. R. Badger has resigned as publicity manager and assistant manager of sales of the Hoskins Manufacturing Co., Detroit, Mich., and has been succeeded by Arthur B. Tilton, who has been assistant advertising manager.

Milliard P. Osbourn, until recently assistant sales manager of the Westinghouse Electric and Manufacturing Company's Boston office, has become member of the firm of Samuel W. Green Co., Springfield, Mass.

H. H. Honaker, master mechanic for the Frisco System, southwestern division, has been transferred from Birmingham, Ala., to Fort Scott, Kan., where he will have charge of the mechanical work for the northern division of the road.

Charles L. Mulligan, for a considerable period connected with the publicity department of the Western Electric Co., and more recently engaged in newspaper editorial work, has joined the organization of Walter B. Snow, Boston, Mass.

J. M. Manley has resigned his position as civic secretary of the Business Men's Club of Cincinnati, O., to become secretary of the Hisey-Wolf Machine Company of that city. Previously Mr. Manley was for a number of years secretary of the Cincinnati Branch of the National Metal Trades Association.

H. E. Harris, who recently resigned his position at the Western Electric Co., where he had been master mechanic and methods engineers, to go with the Wells Bros. Co., Greenfield, Mass., as production engineer and assistant superintendent, has been appointed general superintendent of their tap and die plant.

E. W. Rogers, general foreman boiler maker of the Rogers Works of the American Locomotive Co., at Paterson, N. J., has been transferred to the Schenectady plant of the American Locomotive Co., succeeding F. G. Bird, formerly general foreman of the Schenectady boiler shop. Mr. Bird has been appointed general foreman of all the plants of the American Locomotive Company.

Paul Kreuzpointner, metallurgist with the Pennsylvania R.R. Co. for many years, and well known as a contributor to our columns, and chairman of the Committee on Industrial Education of the American Foundrymen's Association, retired on pension on April 1, under the pension system in operation on the Pennsylvania R.R. He has been in the employ of this company since 1879.

OBITUARY

Thomas Speed, for a number of years factory superintendent of the Garford Co., Elyria, O., died on March 22. Mr. Speed was but 48 years old and has been connected with the Garford Co. since 1902.

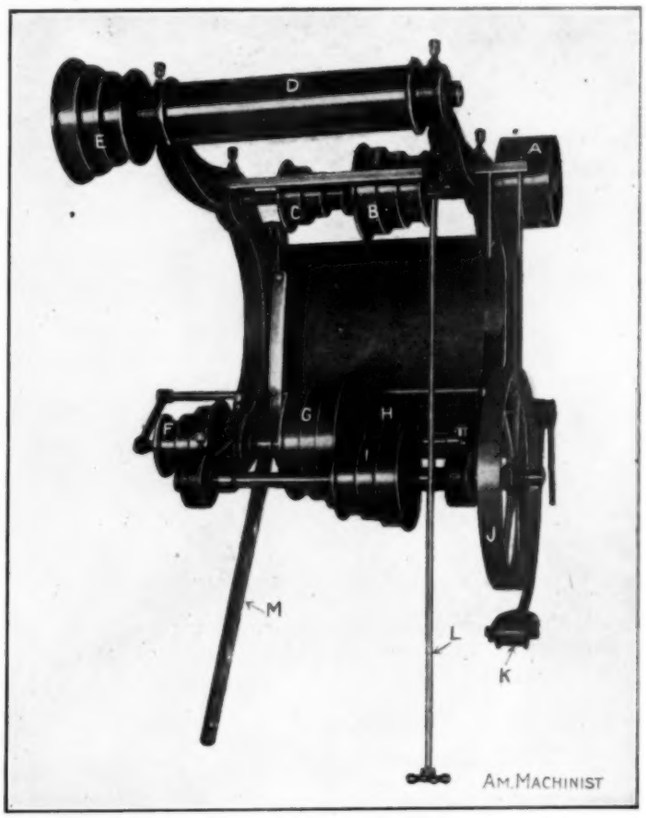
Elias G. Heller, president of the Heller Bros. Co., Newark, N. J., died at his home in that city on March 25. He was president of the File Manufacturers Association of United States and also president of the Heller Tool Co. Mr. Heller was 75 years old and a native of Newark.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

New Grinder Countershaft

The illustration shows the type of countershaft now being built for the grinders of the Rivett Lathe & Manufacturing Co., Brighton, Mass. It is, as can be seen, a complete unit made to be fastened to the wall.



NEW RIVETT COUNTERSHAFT

The driving belt comes to the tight and loose pulleys *A*, the belt being shifted to the handle *L* from one position to the other. The ranges of speed are secured by belting between the three-step cones *B* and *I*. The grinding-wheel spindle is driven from the aluminum pulley *J*, the belt being kept at the proper tension by the idler *K*, while the cone *H* drives the mechanism controlling the table travel.

A belt from *C* to *G* drives *F* and *E*, which in turn drive the drum *D*, on which the belt driving the work spindle runs. This also has three changes of speed, according to the steps used. A clutch, operated by the handle *M*, controls the driving of the drum *D*, so that the work may be stopped at will.

Two Portable Electric Drilling Machines

The portable electric driller, shown in Fig. 1, is 10x4 in., has a capacity of ¾ in. in steel and weighs 6½ lb. It operates at a normal speed of 900 revolutions per minute.

FIG. 1. PORTABLE ELECTRIC DRILLING MACHINE

The hollow side handle carries the control switch of the quick-break, push-button type, a red button starting and a black button stopping the drill. The gears are of steel and the bearings tobin bronze. The chuck is the two-jaw type and is screwed onto the spindle, so that it will not loosen while the drill is in use.

The machine shown in Fig. 2 has a capacity of ¾ in. in steel, weighs 22 lb. and is 15x5 in. Its general construction is similar to the machine shown in Fig. 1. Annular ball bearings are used on both ends of the armature shaft, and the gears are of hardened steel and Parson's bronze. The screw feed telescopes into the hollow motor shaft.

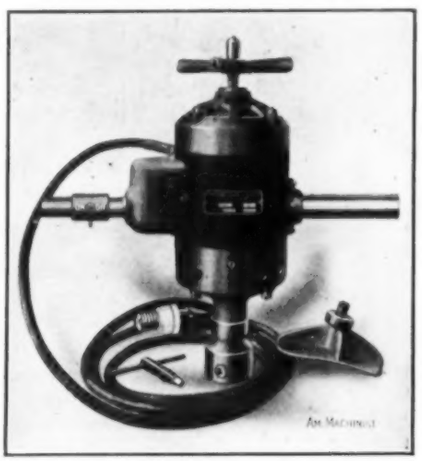


FIG. 2. PORTABLE ELECTRIC DRILLING MACHINE

Both machines are recent products of the American Electric Tool Co., West Newton, Mass.

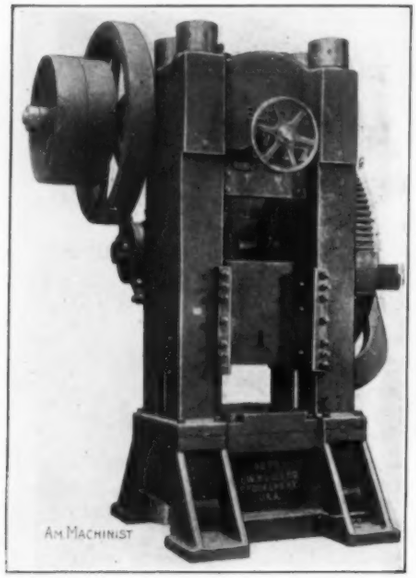
A Large Knuckle Joint Press

One of a new line of knuckle-joint presses recently developed by the E. W. Bliss Co., Brooklyn, N. Y., is shown in the illustration. These machines are especially adapted for heavy stamping and embossing operations on steel, brass, copper, silver, brittania, etc.

The knuckle-joint principle used gives a powerful movement to the slide at the end of the stroke when the work is being done, providing in addition a slow movement at this point, which is desirable when it is required to have the metal flow while under pressure, as is the case in embossing. The machine is capable of exerting a pressure of 800 tons.

As will be seen, the bed is stationary and the toggle links are placed above the

slide in the same position as pitmans in an ordinary crank press, and operated by a crankshaft in the rear of the press. This construction allows a longer stroke to the slide, and permits the use of positive knockout attachments in the bed and cross-bar knockouts in the slide.



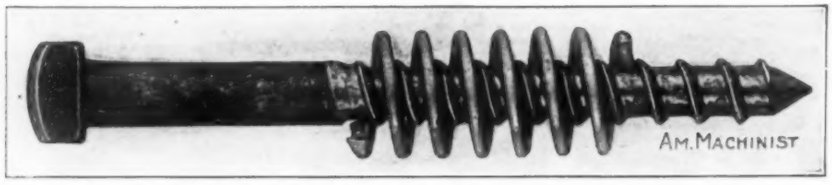
LARGE KNUCKLE-JOINT PRESS

The jaw clutch with which the machine is operated, has three engaging points and is operated by a foot treadle at the right of the machine. The necessary adjustment for dies and pressure is obtained by a taper wedge adjustment. The position of this wedge is adjusted by means of a screw, which is in turn operated by means of the handwheel shown. The distance between uprights is 28 in., stroke of slide 2 in., and total weight 45,000 lb.

Anchor Screw

The illustration shows an anchor screw, designed primarily for use in concrete, stone, masonry, tile, etc.

The idea is to obtain a metal-lined screw hole that will increase the holding power of the screw.



SCREW ANCHOR

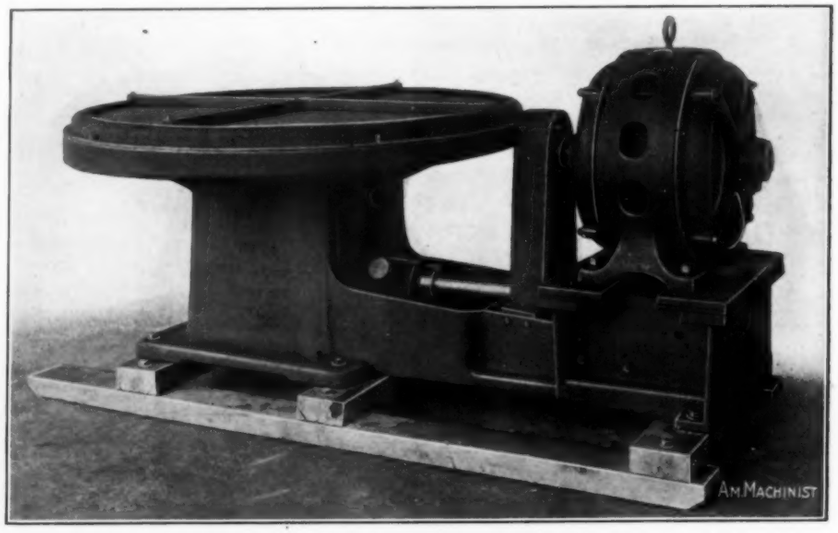
This anchor screw is manufactured by the Richmond Screw Anchor Co., 9 Church St., New York City.

Vertical Spindle Disk Grinder

The machine shown herewith is of the vertical-spindle type, and has a 53-in. diameter disk wheel. It is arranged for direct-connected motor drive.

A 15-hp. motor, mounted on the pedestal at the right end, drives the main shaft of the machine by a silent chain. The shaft drives the disk-wheel spindle through bevel gears, which are fully inclosed and run immersed in oil. The disk wheel is driven at 500 r.p.m. The complete machine weighs 4500 pounds.

It is a recent product of the Gardner Machine Co., Beloit, Wis.



MOTOR-DRIVEN VERTICAL-SPINDLE DISK GRINDER

A Valve Grinder

The McConnell-Browning Engineering Co., Richmond, Va., manufactures a gas- or gasoline-engine valve grinder, invented by DeWitt G. Vaughn.

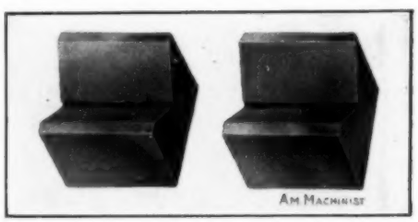
This grinder is very simple in action. The reversing motion necessary to properly grind a valve is given the shaft by means of a worm and sleeve, a reciprocating motion being imparted to the sleeve by turning the crank to which it is fastened by a connecting rod. Means are provided for shifting the position of the valve on its seat during the process of grinding, without removing the tool from contact.

The illustration, showing the device complete and disassembled, gives a clear idea of its construction and action.

HAND-OPERATED VALVE GRINDER

Plain V-Blocks

The illustration shows a pair of V-blocks, designed for use in laying out and drilling work. Each is 1x1x7/8 in., hardened.



PLAIN V-BLOCKS

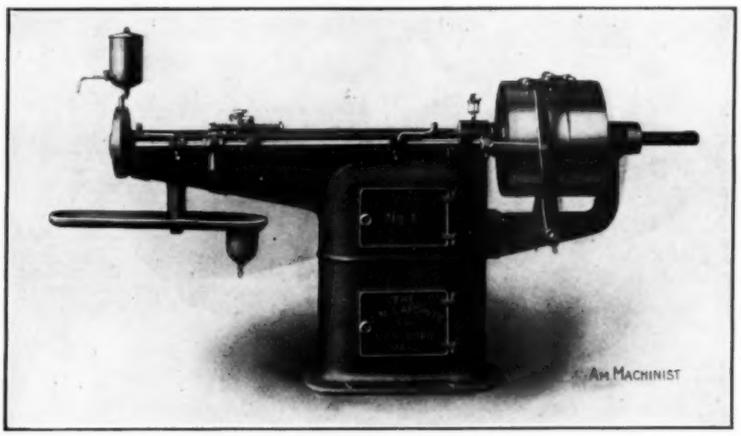
The blocks are made by the Milliken Machine Works, West Newton, Mass.

A Horizontal Broacher

The halftone shows a light type of broacher, recently developed by the J. N. Lapointe Co., Marlboro, Mass.

The machine has been designed particularly for small keyseating, and has a capacity to cut a keyway up to ⅜ in. wide, and in most cases can do two to four pieces at a time, depending on the length of the work.

It has a sliding head of 40-in. stroke, actuated by a 2-in. nonrevolving screw passing through a bronze revolving nut, which is inserted into the hub of the driving pulley. The two loose pulleys are mounted on the hub of the tight pulley, which hub acts as a bearing for the driving mechanism. The combination of the three pulleys, consisting of two loose and one tight, is similar to the arrangement used on planers.

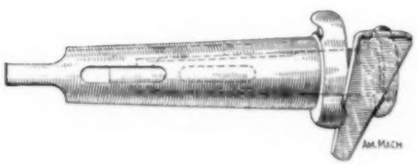


HORIZONTAL BROACHER

The driving or returning belt can be shifted either by hand or by the automatic stop. The automatic stop consists of an adjustable dog, which can be set to any position to stop the sliding head. The machine is provided with a ball-bearing thrust.

Drill Socket

The line cut herewith shows a drill socket developed by Scully-Jones & Co., 316 Railway Exchange Building, Chicago, Ill.



DRILL SOCKET

It is made of one solid piece, hardened and ground, having a key on the inside and a keyway on the outside, extending almost the entire length of the socket, giving a positive drive and eliminating twisting of tangs either on the drill or socket.

The outer keyway, forming the body drive for the sockets when nested, eliminates twisting at the spline. The collar or reinforcement around the base, increases the strength and life of the socket.

Larger Tool Builders' Association

(*Continued from page* 560)

cided gain in membership is reported, is any token of their real feelings, the majority is in favor of extension at least up to the limits of possible membership, and there is absolutely no question that the association grows in importance to each individual with its growth in membership.

INFLUENCE OF A RELATED MEMBERSHIP

Also if the idea of handling special business in committee meetings was properly considered, it might ultimately lead to the establishment of committees of trade journalists, and even dealers. If it was not thought wise to admit the journalists and dealers to general membership, an arrangement might finally be made to meet on the same day, and at the same place, for the purpose of devoting a given time to a general conference. But however the matter may be finally arranged, there can be no doubt in the mind of anyone of the great increase in strength and importance that would accrue to an association as complete as suggested, as against the present condition, where the various interests have no direct connections.

The technical journals, if interested, are in a position to do an immense amount of good in the effort to clean up mechanical language, as, without doubt, they are the logical leaders in work of this kind and should take pride in having their editorials, advertisements, indexes, and in fact, every word that is printed as nearly correct and easy to understand as possible. There is positively no question that proper language lends valuable dignity to printing, while inadequate, meaningless, or clipped words or expressions are the logical adjuncts of ignorance.

While the mechanical-engineering profession is perhaps the most important one there is, as without it we would have no army, no navy, no railroads, no telegraphs, no telephones, and so on down to the very smallest manufactured article, it nevertheless suffers more from a lack of proper dignity than perhaps any other calling. Anything, therefore, that could be done to raise the profession to its proper level should be gladly undertaken by everyone in any way even remotely interested in the work, but more especially by those who are so directly interested as the makers of American machines.

Even in the mechanical-engineering schools, the effect of the long neglect of the language is seen. It is hoped that the schools will look carefully into the matter, and if it is really an important work, do what they can in the way of insisting on the use of good language to correct the situation.

Steel Car Repairs

When steel freight cars were first introduced, car-department officials expressed considerable anxiety as to how they should go about to provide facilities for maintaining and repairing them. It was soon found, however, that the problem was not nearly as troublesome as it first appeared. Very little new equipment was required and most of it was comparatively simple and crude. Gradually, as the number of cars in service has increased, more and more refinements have been added, although these in most cases have proved neither extensive nor expensive. The Pittsburg & Lake Erie, one of the first roads to introduce steel freight cars, made more or less elaborate provision for handling the work by the erection of a steel-frame brick steel-car repair shop at McKees Rocks, Penn., but outside of the overhead cranes for handling the cars and a steel-frame repair jack for restoring the cars and their parts to the proper shape when they became distorted, only a few other tools were provided, including the necessary furnaces for heating the parts.

The Pennsylvania Railroad has a large steel-car shop at Altoona but ordinarily it is used largely for building new equipment and only the heaviest repairs to steel freight cars are made in it. One of the most interesting practices at that shop is the provision of crane service for turning the bodies of hopper and gondola cars upside down for making certain classes of repairs, which it is difficult to handle when the bodies are in their normal position.—*American Engineer.*

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

METAL WORKING

NEW ENGLAND STATES

The Marlboro Trust Co., Boston, Mass., has awarded the contract for the construction of a garage on Bickerstaff St. Estimated cost, $40,000. A. H. Vinal, 19 Milk St., is the architect.

The Eliot Land Trust Co., 1 Beacon St., Boston, Mass., is receiving bids for the erection of a two-story garage, 60x25 ft. Estimated cost, $8000. S. S. Levy, 35 Court St., Boston, is the architect.

The Macallen Co., manufacturer of electrical supplies, Broadway and Dorchester Ave., Boston, Mass., has had plans prepared by M. D. Stafford, architect, 259 Summer St., for the construction of a factory, six stories high, 50x230 ft. Estimated cost, $100,000.

The Berkshire Motor Co. is planning to erect a plant at Cambridge, Mass., consisting of a three-story, concrete, manufacturing building, 50x239 ft., with provision for two additional stories, and a boiler house.

The Gerstein Copper Boiler Works, First St., South Boston, Mass., is receiving bids for the construction of a three-story factory, 39x90 ft. Samuel S. Levy, 35 Court St., is the architect. Estimated cost, $12,000.

Samuel Squire will erect a large commercial garage, in Westfield, Mass.

Plans have been prepared by W. P. Crabtree, architect, New Britain, Conn., and estimates will be received for a new fireproof pattern-storage building, to be erected at the Sessions foundry, replacing the one recently destroyed by fire. The new building will be of brick, 50x100 ft., five stories high.

A permit has been granted for the new building to be erected by the New Britain Machine Co., on Chestnut St., New Britain, Conn. Plans have been completed. There will be one new building, 57x150 ft., four stories high, with an annex, 56x38 ft., and a one-story building 38x70 ft. The present building, which is 57x144 ft., will be raised three additional stories, with a four-story annex 88x40 ft. Noted Mar. 21.

Excavation work has been started for the new addition to the factory of the Star Pin Co., at Shelton, Conn. L. W. Robinson, New Haven, Conn., is the architect.

Work has been started on a new garage for Joseph Gerli, on Seaside Ave., Stamford, Conn. The building will be two stories high, 28x52 ft., of hollow tile block and stucco construction.

Blanchard & Barnes, architects, 15 West Thirty-eighth St., New York, are preparing plans for the erection of a two-story garage, 44x70 ft., at Thompson, Conn., for N. B. Ream.

The contract for an addition to the plant of the Wallingford Co., Wallingford, Conn., manufacturer of silverplated novelties, has been awarded. The building will be of brick, 36x156 ft., four stories high, of mill construction, with an ell 22x22 ft. W. E. Becroft is the architect.

MIDDLE ATLANTIC STATES

The Deyo-Macey Engine Co. has purchased the old machine shop and other buildings of the Delaware & Hudson R.R., in Binghamton, N. Y. They will be torn down and new buildings erected for the engine company. The company manufactures gas engines.

The International Typesetting Machine Co. will erect a typesetting-machine factory at Furman and Montague Sts., Brooklyn, N. Y. Herman Ridder, William and Spruce Sts., New York, N. Y., is interested.

The Doehler Die Casting Co., Court and Ninth Sts., Brooklyn, N. Y., has awarded the contract for the construction of a new factory building. The structure will be seven stories high, 50x100 ft., of reinforced-concrete construction. Estimated cost, $45,000. Noted Mar. 28.

Fire damaged the car barns of the Buffalo & Lake Erie Traction Co., Fredonia, N. Y., to the extent of $20,000. George Baker, Fredonia, is superintendent.

Rouse & Wailrod will erect a two-story garage, 60x100 ft., at Herkimer, N. Y. S. W. Cassidy, Herkimer, is the architect.

The Case Brothers Cutlery Co., Little Valley, N. Y., is considering the erection of a plant at Springville, N. Y., to replace its recently burned factory at Little Valley. Noted Feb. 22.

The Watson Engineering Co., 38 West 32nd St., New York, has leased a factory on Lawrence St., Flushing, N. Y. The company will manufacture taxicabs.

Frederick Hart will build a $25,000 factory in Poughkeepsie, N. Y., to manufacture tabulating machines, etc.

John R. Taylor, 559 Monroe Ave., Rochester, N. Y., will erect a two-story garage, 108x50 ft. C. F. Leggett, 1227 Granite Building, Rochester, is the architect.

Dr. H. T. Williams, 274 Alexander St., Rochester, N. Y., will erect a garage. Connelan & Casebeer, German Insurance Building, Rochester, are the architects.

A. H. Lambert, Atlantic City, N. J., will erect a three-story garage, 50x132 ft. Estimated cost, $15,000. W. S. Hewitt, Bartlett Building, Atlantic City, is the architect.

The contract for the construction of a new factory for the Oxweld Acetylene Co., Newark, N. J., has been awarded at $80,000. The building will be three stories high, 75x240 ft., and will be erected at 646 Frelinghuysen Ave. Fred A. Phelps, 15 Clinton St., is the architect. Noted Mar. 21.

The conract for the construction of a 2½-story garage, 30x67 ft., at Bala, Penn., has been awarded. The owner is I. W. Roberts, 1626 Land Title Building, Philadelphia, Penn. The architects are Day Brothers, & Klander, 923 Chestnut St., Philadelphia.

John McKeeman, 1488 North Fifty-third St., Philadelphia, Penn., will erect a one-story garage to cost $3000. Plans have been completed. E. A. Wilson, 1208 Chestnut St., Philadelphia, is the architect.

Irwin & Leighton, Franklin Building, Philadelphia, Penn., are receiving bids for the construction of an addition to the plant of the Esterbrook Steel Pen Co., Cooper St., Camden, N. J. Ballinger & Perrot, 1211 Arch St., Philadelphia, Penn., are the architects.

Bureau Brothers, Philadelphia, Penn., are planning to erect a foundry, machine shop and office building at Twenty-third and Westmoreland Sts. W. L. Baithe is architect.

The Brill Car Works, Philadelphia, Penn., will erect an addition to its truck shop at Sixty-second St. and Woodland Ave. The contract has been let.

The Standard Underground Cable Co., Westinghouse Building, Pittsburg, Penn., has awarded a contract for the construction of a new three-story, 40x100-ft. factory. The W. G. Wilkins Co., Westinghouse Building, Pittsburg, has charge of the work.

The garage of the Oakland Automobile Co., 3415-17 Forbes St., Pittsburg, Penn., was destroyed by fire, Mar. 19. Loss, $40,000.

The garage of Charles Dreifus, 5607 Baum St., Pittsburg, Penn., was damaged by fire, Mar. 21. Loss, $4500.

A two-story garage and stable will be erected at Roxborough, Penn., by St. Timothy's Hospital, Ridge and Jamestown Aves., Roxborough. Peuckert & Wunder, 310 Chestnut St., Philadelphia, Penn., are the architects.

W. S. Wells, South Bethlehem, Penn., is receiving bids for the construction of a one-story garage. A. W. Leh, Post Office Building, South Bethlehem, is the architect.

The Alma Manufacturing Co., 111-113 Light St., Baltimore, Md., will erect two additions to its plant on South Fulton Ave. The contract has been awarded.

Edward Renneburg & Sons Co., Baltimore, Md., has purchased a four-story factory building at 2639 Boston St., Baltimore, and will equip it as a machine shop.

SOUTHERN STATES

Jones Hasp & Lock Co., Warrenton, N. C., recently incorporated, will erect a plant for the manufacture of hasps and locks.

Edwin Williamson, Anniston, Ala., contemplates the establishment of a plant in Birmingham, Ala., for the manufacture of adding machines.

Reports announce that the Illinois Central R.R. is considering plans for the removal of its repair shops from McComb City, Miss., to Jackson. New shops will be erected. F. B. Barclay, McComb City, is master mechanic.

F. W. Ferguson, 1600 Rosewood Ave., Louisville, Ky., is organizing a company to manufacture chimney caps and other sheet-metal specialties.

The Kentucky Gear & Machine Co., Eighth and Jefferson Sts., Louisville, Ky., is contemplating making some improvements in its plant. These have not yet been definitely determined. G. W. Binder is general manager of the company, which makes gears and metal saws.

The Hickman Motor Works, Hickman, Ky., will probably be enlarged by Adams Bros., who have purchased it from Hale & Caruthers. An addition will be built to take care of motor-boat repairs.

The shop of the Mt. Pleasant Machine Co., Mt. Pleasant, Tenn., has been purchased by Dugger & Willis, of that city, and a foundry will be built and operated in connection with the plant.

MIDDLE WEST

The Lake Shore & Michigan Southern Ry. will make extensive improvements at Airline Junction, Ohio, near Toledo. These will include repair shops and two roundhouses, each having a capacity of 15 locomotives.

The Lima Locomotive & Machinery Co., Lima, Ohio, has had plans prepared by Kahn & Wilby, 58 Lafayette Ave., Detroit, Mich., for the construction of a new machine shop. The plans call for a structure two stories high, 150x350 ft.

Plans are being prepared for the construction of a new factory for the National Machinery Co., Tiffin, Ohio. It will be of brick, mill construction, three stories high, and will be located at Greenfield and Stanton Sts.

The Cleveland-Galion Motor Truck Co., a new automobile company, will shortly establish a plant, at Galion, Ohio. The total capitalization is $500,000, to which local parties have subscribed $76,500.

The Berger Manufacturing Co., manufacturer of steel ceilings, Canton, Ohio, will erect a four-story plant, 80x300 ft., of brick and steel construction. The estimated cost is $50,000.

The Roath Heating & Ventilating Co., Akron, Ohio, will buy complete tinshop tool equipment. S. E. Roath is superintendent.

The Clyde Auto Sales Co., Clyde, Ohio, will build and equip a large garage.

The West Hill Auto Sales Co., Akron, Ohio, will equip a large commercial garage. S. A. Kepler is president.

The Perfection Spring Co., Central Ave., Cleveland, Ohio, has awarded a contract to J. C. Campbell, 2204 East Eighty-fourth St., for the construction of a factory at East Sixty-fifth St. and Central Ave. It will be of brick construction, one story high, 200x280 ft., and will cost $35,000.

The National Screw & Tack Co., East Seventy-fifth St. and Stanton Ave., Cleveland, Ohio, has awarded a contract to the D. C. Griese & Walker Co., 1417 Prospect Ave., at $15,000, for the erection of a factory. It will be five stories high, 37x50 ft., of brick and steel. Noted Mar. 28.

The Goby Engine Co., Cleveland, Ohio, will shortly commence work on a large plant. The company was recently incorporated to manufacture the Goby slide-valve engine for the trade.

A garage will be built and equipped, at 1085 Parkside Rd., Cleveland, Ohio, by E. A. Curtis.

The National Brass Bed Co., Cleveland, Ohio, will equip a plant to manufacture brass beds. J. A. Schlitz is manager.

The W. S. Tyler Co., 3618 St. Clair Ave., Cleveland, Ohio, manufacturer of wire products, will erect a four-story factory and a boiler house.

The American Tool Works Co., Sixth and Eggleston Ave., Cincinnati, Ohio, is planning the erection of a new plant. Several sites are under consideration.

The National Steel Post & Fabric Co., Enid, Okla., will erect a plant at Cincinnati, Ohio. G. G. Anderson is president.

The McNaul Boiler Works, of Toledo, Ohio, are erecting a new factory.

The Maplewood Garage, Toledo, Ohio, will be completely renovated and its capacity doubled. H. W. Bowers is manager.

The Willys-Overland Co., Toledo, Ohio, is contemplating making extensive additions in the near future. Plans are being prepared for a building 300x181 ft., which will be erected on a 15-acre tract recently purchased. Plans are also being drawn for a new 180x80-ft., three-story office building.

The Ring Electric Co., Anderson, Ind., has awarded a contract to David Eshelman & Sons for the erection of a building, 40x120 ft., which will be constructed of brick, steel and cement.

The Cleveland, Cincinnati, Chicago & St. Louis Ry. will probably require some machine tools in its Beech Grove, Ind., shops.

Bids are being received by Charles B. Weatherhogg, Hamilton National Bank Building, Fort Wayne, Ind., for the construction of a garage for S. M. Foster. It will be two stories high, 60x165 ft.

Smith, Hinchman & Grylls, 710 Washington Arcade Building, Detroit, Mich., have awarded the general contract for the one-story and basement factory, 99x100 ft., for the Hygeia Filter Co., 142 Larned St., to the Vinton Co., 120 East Woodbridge St., at $25,000.

R. H. Marr, 1529 Ford Building, Detroit, Mich., is preparing plans for a one-story factory, 150x40 ft., for the American Brass & Metal Works, 82 Washington Ave. It will be of reinforced-concrete construction and will cost $25,000.

Baxter, O'Dill & Halpin, 1024 Hammond Building, Detroit, Mich., are preparing plans for a new two-story and basement factory, 60x90 ft., for the C. M. Hall Lamp Co. C. M. Hall, secretary, 363 East Hancock Ave. The cost is $25,000.

The Essley Machine Co., Jecerson St., near Madison St., Chicago, Ill., was destroyed by fire. Loss, $3000.

The Miehle Printing Press Co. have commenced a three-story brick addition to their plant, at Roby and Fourteenth Sts., Chicago, Ill., and will add new tools and machinery.

The contract for the construction of a two-story, 80x100-ft. factory for the Hanna Engineering Works, 2059 Elston Ave., Chicago, Ill., has been awarded to R. F. Wilson & Co., 154 West Randolph St. Robert C. Fletcher, 179 West Washington St., is the architect.

A. P. Gassman, architect, 138 West Washington St., Chicago, Ill., is receiving bids for the construction of a garage for M. R. Rufa. It will be one story, 25x118 ft., and cost $4500.

The Grand Boulevard Automobile Garage, at Grand Boulevard and East Fortieth St., Chicago, Ill., was destroyed by fire, Mar. 22. Loss, $100,000.

Plans are being prepared by J. F. McCoy, architect, American Bank Building, Danville, Ill., for the construction of a two-story garage, at Hoopeston, for C. C. Williams. The cost is $5000.

Plans are being completed for the construction of a two-story foundry for the Enterprise Foundry Co., Halstead St., Harvey, Ill. J. A. Pettigrew is manager. The estimated cost is $50,000.

The Urbana Automobile Co., Champaign, Ill., will build a 100x50-ft. addition to its garage.

The Racine Manufacturing Co., Racine, Wis., is contemplating the erection of a group of new buildings in the course of the present year, at a cost of $800,000. The company makes, among other things, automobile bodies.

A garage will be erected at Menomonee Falls, Wis., by J. B. & E. J. Wittlin.

The J. I. Case Threshing Machine Co. has let a contract for 5000 tons of structural shapes for its plant extension, at Racine, Wis. Noted Feb. 29.

The International Hoist Co., Antigo, Wis., has purchased four lots along the Chicago & Northwestern R.R. as a site for its new plant, to be erected this year, at a cost of $30,000. Plans have not been prepared. George B. Herman is general superintendent. Noted Feb. 22.

The United Refrigerator Co., Kenosha, Wis., is planning to erect several new buildings this year, but plans are not yet ready. Peter B. Nelson is president. The concern manufactures ice and refrigerating machinery.

The Milwaukee Woven Wire Works, Thirtieth and Clarke Sts., Milwaukee, Wis., will erect an addition, 116x120 ft., two stories high.

WEST OF THE MISSISSIPPI

The contract for the erection of a one-story and basement garage, 66x88 ft., for W. A. Prince, Grand Island, Neb., has been awarded to William Southman.

Plans have been completed and bids are being received by Pond & Pond, 64 East Van Buren St., Chicago, Ill., for the construction of a 2½-story garage, 71x84 ft., for H. N. Hudson, St. Louis, Mo.

The Twyford Auto Manufacturing Co., Houston, Texas, which was recently organized here, with a capital of $400,000, will construct a plant to manufacture automobiles. M. J. Moore is president and R. E. Twyford, superintendent.

Dozier Brothers, Taylor, Tex., have let contract for the construction of a cement and sheet-iron garage. Work has begun.

The Tulsa Sheet Metal Co., Tulsa, Okla., recently incorporated, will erect a plant to manufacture tanks, ventilator windows and skylights. Thomas J. Byrne, president; William Rishbarger, secretary-treasurer.

WESTERN STATES

The Milwaukee Steel Casting Co., Milwaukee, Wis., will erect a manufacturing plant at Kirkland, near Seattle, Wash. The estimated cost is $50,000.

The Interstate Manufacturing Co., Spokane, Wash., will erect a factory to cost $25,000 to manufacture window screens and insect destroyers.

The Lozier Motor Co., Seattle, Wash., will erect a commercial garage and repair plant at Broadway and Pike St., Seattle.

The Ford Motor Car Co., Detroit, Mich., will establish a machine shop at Seattle, Wash., primarily for assembling work. R. P. Rice, local manager, has charge of the work.

The Great Western Smelting & Refining Co., 1924 Grant St., Seattle, Wash., will build a new refining and smelting plant at Ninth Ave. and Holgate St. It will be of reinforced concrete and steel, and will cost $250,000.

George A. Dow, president of the Dow Pumping Engine Co., is completing a factory at Alameda, Calif., for the construction of the Willans Diesel engine. The new factory involves an immediate investment approximating $1,000,000.

The contract for the construction of a two-story garage, to cost $12,000, for the Cousins-Howland Auto Co., Hanford, Calif., has been awarded to H. Anderson, Coalinga, Calif.

The Star Drilling Machinery Co., Akron, Ohio, will erect a manufacturing plant at Long Beach, Calif.

R. F. Bennett, Los Angeles, Calif., will build a commercial garage and repair plant on East First St., Los Angeles.

The city of Riverside, Calif., plans to erect a municipal garage and machine shop.

The Lewis Motor Truck Co., San Francisco, Calif., is contemplating the erection of an automobile factory at Stockton, Calif.

The American Can Co., Fourteenth St. and Tenth Ave., New York, N. Y., will erect a new manufacturing plant at San Jose, Calif., estimated to cost $75,000.

CANADA

The Bowmansville Foundry Co., Bowmansville, Ont., has increased its capital stock from $40,000 to $100,000. A portion of the increased capital will be used to improve the manufacturing facilities.

GENERAL MANUFACTURING

NEW ENGLAND

The sawmill of George W. Lyude, Williamstown, Vt., was destroyed by fire, Mar. 15. Loss, $155,000.

The Tallyho Knitting Co., East Douglas, Mass., has purchased land on Mechanic St., and will erect a new factory.

Work has been started on the superstructure of the new mill for the Hampden Co., Easthampton Mass. The building will be of brick, 270x120 ft., four stories high.

The contract for an addition to the mill of the Crocker-Burbank Co., Inc., Fitchburg, Mass., manufacturer of paper, has been awarded. It will be of brick, mill construction, 80x100 ft., two stories high. George F. Harty is engineer. Noted Mar. 21.

The Greenfield Baking Co., Greenfield, Mass., will enlarge its present plant.

The Arthur A. Williams Shoe Co., Holliston, Mass., has plans for a three-story addition, 110x60 ft., of wood. G. H. Nichols, Holliston, is the architect.

The Yale Knitting Co., Malden, Mass., manufacturer of knit goods, is considering the erection of a new mill. It will be of brick, four stories high, 50x100 ft.

The city of Northampton, Mass., will spend $20,000 for extensions and improvements to its water system.

The Berkshire Steam Laundry, Pittsfield, Mass., recently incorporated, will expend $10,000 for new machinery for its plant on Northrup St.

The Faulkner Lumber Mill, Clapp Ave., Pittsfield, Mass., was damaged by fire, Mar. 22. Loss, $4000.

The National Equipment Co. will erect a factory, at Springfield, Mass., 80x360 ft., three stories, with a wing 80x100 ft., of brick, mill construction. A brick power house also will be built. Plans will be ready April 15. Samuel M. Green, Inc., 318 Main St., Springfield, are the architects.

The Standard Electric Time Co. has purchased a three-story building, 50x80 ft., with a two-story ell 30x40 ft., at Springfield, Mass. The company will move its business from Foxboro, Mass. George L. Riggs is general manager.

The Fitchburg Paper Co. will soon start an addition to its No. 2 mill, at West Fitchburg, Mass. The building will be of brick, 40x75 ft., part one story and part two stories high. It is planned to add new machinery and to operate by electric power.

The New England Corset Co., 132 Green St., Worcester, Mass., has awarded the contract for an additional story to its factory.

Fire destroyed the factory of the Inlaid Co., manufacturers of combs, Providence, R. I., Mar. 9.

Plans for the erection, in Bridgeport, Conn., of the new plant of the Birdseye-Somers Co., corset manufacturer, are nearing completion. The main building will be of brick, three stories high. The power plant will be equipped with two 150-hp. boilers, an electric and gas plant, steam heat, brick stacks, and a switchboard. J. E. Nitchie, 150 Nassau St., New York, is architect. Noted Mar. 14.

The general contract for the addition to the Empire Steam Laundry, Sheldon St., Hartford, Conn., has been awarded. The building will be of brick, 26x129 ft., two stories high. E. M. Stone is the architect. Noted Mar. 7.

R. A. D'Anino has been commissioned to prepare plans for an addition to the factory of the Strouse Corset Co., on Vernon St., New Haven, Co..n. The new building will be 47x70 ft., three stories high, fireproof, of brick or reinforced-concrete construction.

H. Hall & Co., organ manufacturers, York and Asham Sts., New Haven, Conn., have purchased land on Campbell Ave., West Haven, as a site for a new factory. The new structure will be 40x150 ft., two stories high, of brick.

MIDDLE ATLANTIC STATES

The tannery of the McKinnon Dash Co., Buffalo, N. Y., has been damaged by fire to the extent of $13,000.

The plant of the Geneva Preserving Co., Geneva, N. Y., was damaged by fire, Mar. 20. Loss, $150,000. Plant will be rebuilt immediately.

The Empire Case Goods Co., Jamestown, N. Y., will enlarge its furniture plant and install a new power plant.

Fire destroyed the leather-dressing plant of Frank Martin, Johnston, N. Y. Loss, $4500.

Fire destroyed the sawmill of N. H. Blacey, Macedon, N. Y., Mar. 22. Loss, $8000.

The factory of the Sambe Manufacturing Co., maker of leather goods, 440 Broadway, New York, N. Y., was damaged by fire, Mar. 26. Loss, $500.

The factory of the Williams Silk Manufacturing Co., 304-310 East Twenty-third St., New York, N. Y., was damaged by fire, Mar. 23.

Bids will be received by M. J. Drummond, commissioner of public charities, New York, N. Y., for the construction of a brick building, to be used as a bone-rendering and grinding plant. It will be located on Blackwell's Island.

Plans have been completed for the erection of a new factory, at Glendale, N. Y., for the Bornn Hat Co., 22 West Fourth St., New York, N. Y. It will be three stories high, 88x134 ft., and cost $25,000. Edward A. McLean, Little Neck, L. I., is the architect.

The Visor Knitting Co., Niagara Falls, N. Y., has purchased the building in which its plant is located and the adjoining property. Work will commence on an addition, which it is expected will be finished in May. The new structure will be of concrete, 50x50 ft. Noted Mar. 21.

The New Process Raw Hide Co., Syracuse, N. Y., will spend $75,000 for enlarging its plant. T. W. Meachem is president.

The Federal Sugar Refining Co., foot of Vark St., Yonkers, N. Y., awarded a contract at $30,000 for the construction of an addition, one story high, 60x100 ft., of brick and steel.

An addition to the plant of the Bayonne Launch Co. is being erected at the foot of East Thirty-seventh St., Bayonne, N. J. It will be 65x75 ft.

The Avoca Silk Mills, Avoca, Penn., owned by Ashley & Co., of Hackettstown, N. J., was destroyed by fire, Mar. 25. Loss, $130,000.

The Cambria Roofing Co. will erect a plant in Johnstown, Penn. The company manufactures paroid, rubberoid and other forms of asphalt roofing, and roofing paints. Walter H. Turner is interested.

The Hygeia Ice & Cold Storage Co., Philadelphia, Penn., has taken out a permit for an addition to its ice plant at 323 North Franklin St., Philadelphia.

The two silk mills of the Avoca Silk Mill Co., Scranton, Penn., were destroyed by fire, Mar. 25. Loss, $300,000.

SOUTHERN STATES

Plans are being prepared by D. Wiley Anderson, architect, 920 East Main St., Richmond, Va., for the construction of a new factory for Binswanger & Co. Noted Mar. 7.

The contract for constructing a water, light and sewer system at Lawrenceville, Va., has been awarded to J. B. McCrary Co., Third National Bank Bldg., Atlanta, Ga., at $50,000.

The Veneer Manufacturing Co., Warwood, W. Va., has been incorporated and will construct a plant for the manufacture of varnishes. Conrad Schneidmiller is an incorporator.

It is reported that the Wiscassett Mills Co., manufacturer of cotton goods, Albemarle, N. C., will erect a new building and install 15,000 spindles, as an addition to its plant.

It is reported that William H. Ragsdale, Jamestown, N. C., is planning the erection of a 5000-spindle cotton yarn mill, at High Point, N. C.

The Durham Hosiery Mills, High Point, N. C., have had plans prepared for the construction of a new mill. It will be of brick, three stories high, 70x150 ft.

E. A. Smith, of Charlotte, president of the newly incorporated E. A. Smith Manufacturing Co., has purchased the holdings of the Rhodhiss Manufacturing Co., at Rhodhiss, N. C. He will erect a new plant costing $300,000. The new mill will have 15,000 spindles and 450 looms.

The Robersonville Tar River Hosiery Mills, Robersonville, N. C., is considering plans for the construction of a mill. It will be 40x100 ft., of brick. J. H. Roberson is Pres.

The shingle mill of Monroe & Johnson, Swansea, S. C., was destroyed by fire, Mar. 21. Loss, $700.

Fire destroyed the sawmill of William Cummings, Hampton, S. C., Mar. 21. Loss, $10,000.

The plant of the Hacker Manufacturing Co., Ehrhardt, S. C., was destroyed by fire, Mar. 9. Loss, $150,000, partly covered by insurance.

The La Grange Knitting Mills, La Grange, Ga., are constructing a new factory, 88x90 ft. Five thousand new spindles will be installed.

The factory of the Columbus Barrel Manufacturing Co., Columbus, Ga., was destroyed by fire, Mar. 18. Loss, $18,000.

The Cowikee Mills, Eufaula, Ala., will erect a new factory and install 8000 spindles.

The Newport Mining Co., Colby-Abbott Building, Milwaukee, Wis., is considering plans for the construction of a plant for manufacturing rosin and turpentine, in Bay Minette, Ala. The estimated cost is $100,000.

The Gateway Furniture Co., North Mobile, Ala., will soon begin work on its new factory.

The Southern Packing & Produce Co., Horn Lake, Miss., has had plans prepared for the erection of an ice plant and abattoir. It will be of steel and concrete, 96x70 ft. Ford N. Taylor is president.

The Consolidated Lumber Co., Indianapolis, Ind., will erect a planing mill at Georgetown, Miss.

A. J. Cloriere & Co., New Orleans, La., will erect a cold-storage plant at Gulfport, Miss., to cost $7000.

The plant of Mente & Co., manufacturers of bags, South Peters and Robin Sts., New Orleans, La., was damaged by fire, Mar. 15. Loss between $5000 and $8000.

The Walsh & Weidner Boiler Co., Chattanooga, Tenn., has increased its capital $50,000, and will erect an addition to its plant for the manufacture of steel tanks.

The American Canning & Preserving Co., Franklin, Tenn., whose plant was recently destroyed by fire, will rebuild immediately. A much larger plant will be erected at a cost of $10,000.

Plans are being considered by Jacobs Bros., for the construction of a new sausage factory at Taylor and Adams Sts., Nashville, Tenn. The estimated cost is $15,000.

It is reported that A. B. Rogan is having plans prepared for the construction of a knit-goods mill, at Rogersville, Tenn.

Edwin T. Lindsey, representing D. C. Eckle, Chicago, Ill., will erect a cotton oil-refining plant at Ridgely, Tenn. A contract was made with the Ridgely Business Men's Club whereby the latter furnished a site for the plant. The investment will aggregate $125,000.

The Friendship Mill Co., Friendship, Tenn., will erect a flour mill with a capacity of 75 barrels a day.

The Volunteer State Phosphate Co., Centreville, Tenn., will make a number of improvements, doubling the output of its plant. It will construct a hydraulic pumping station. The cost of the improvements will be $25,000.

Keeley Institute, Crab Orchard, Ky., will install an electric-light plant, at a cost of $4000. T. B. Willis is in charge.

The Baldwin Packing Co., Paris, Ky., is planning the erection of a plant; a refrigerating system will be included. The company is capitalized at $40,000. George Wyatt, J. D. Booth and others are interested.

Schulz & Boyer, Birmingham, Ala., are removing their button factory to Knoxville, Tenn., and will enlarge the plant.

The Rineyville Roller Mills Co., Rineyville, Ky., will erect a flour mill of 50 bbl. capacity. Work on the building will be begun within 30 days. Leo Richardson, F. A. Wiseman and H. C. Beatty are interested. The company is capitalized at $10,000.

The Mengel Box Co., Louisville, Ky., is to be in the market for machinery in the near future, as its new box factory at Winston-Salem, N. C., has reached a point where installations of equipment may be begun. T. S. Hamilton is mechanical engineer.

The Modern Mill & Elevator Co., Lebanon, Ky., will erect a flour mill of 50 barrels daily capacity.

MIDDLE WEST

A factory at Lancaster, Ohio, occupied by Martin Bros., manufacturers of gloves and Frankenberg Bros., manufacturers of boxes, was destroyed by fire, Mar. 16, at a loss of $5000.

The plant of the Welser Leaf Tobacco Co., Franklin, Ohio, was destroyed by fire, Mar. 17. Loss, $35,000.

The Seville Milling Co., Seville, Ohio, will erect a new elevator and grist mill. H. Peck is superintendent.

The Diamond Rubber Co., Akron, Ohio, has commenced work on a six-story building, 275 ft. long, which will be an extension to building No. 15 and be used for the manufacture of automobile tires.

The Federal Garment Co., Canton, Ohio, will need power-plant equipment.

The Trimble Brick Manufacturing Co., Trimble, Ohio, will buy power-plant equipment.

The Strong Manufacturing Co., Bellaire, Ohio, is erecting an enameled-ware factory at Sebring, 300x600 ft.

J. Neal will install power-plant equipment in his new warehouse at Seventy-second and Euclid Ave., Cleveland, Ohio.

The Cleveland & Sandusky Brewing Co., American Trust Building, Cleveland, Ohio, will make additions to its power plant.

The Werk Soap Co., 408 Poplar St., Cincinnati, Ohio, will receive bids for the erection of a factory and power house.

The Kilbourne & Jacobs Manufacturing Co., manufacturer of farm implements, Lincoln and North Fourth Sts., Columbus, Ohio, has had plans prepared for the construction of a new factory. The structure will be two stories high, 250x300 ft., and will cost $60,000. James Kilbourne is president.

The Toledo Ice Delivery Co., Toledo, Ohio, has increased its capital and will build a new ice-making plant.

The contract for the construction of the new factory to be erected on West Sample St., South Bend, Ind., by Wilson Bros., shirt makers, has been awarded to the George J. Hoffman Co., at $16,000.

The Auburn Handle factory, Auburn, Ind., which was destroyed recently by fire, will be rebuilt. W. R. Vaughn is manager.

The Citizens Gas Co., Indianapolis, Ind., has awarded the contract for a 3,000,000-cu.ft. gas holder.

The Northwestern Leather Co., Manistique, Mich, has plans prepared for an addition, 50x200 ft., to its tannery.

The Barcus Bros. sawmill, Muskegon, Mich., was destroyed by fire, Mar. 20. Loss, $6000.

The C. H. Little Co., builders and contractors, of Detroit, Mich., has purchased land and will erect a placer mill for the separation of sand and gravel.

The Michigan Brewing Co., of Detroit, Mich., is erecting additions to its present plant.

The Sanitary District, of Chicago, will build a one-story brick electric station at 1752-54 Byron St. and equip it with machinery.

C. F. Sorenson, architect, 1301 North Maplewood Ave., Chicago, Ill., is preparing plans for the construction of a new factory for the Colonial Chair Co., 1740 North Maplewood Ave. It will be four stories high, 100x125 ft.

Bids, which were received by William C. Zimmerman, state architect, 64 East Van Buren St., Chicago, Ill., for the construction, by the state, of a laundry, at St. Charles, have been rejected. New bids will be received.

Bids are being received by the Milford Canning Co., Milford, Ill., for the erection of a cannery, at Milford. A building three stories high, and costing $70,000, will be erected. R. Egley is Secy.

Plans have been completed by Payne & Son, architects, Carthage, Ill., for the construction of a factory at Albion, Ill., for the Albion Shale Brick Co. The structure will be three stories high, 236x408 ft., and will cost $400,000.

The contract for constructing a waterworks system at Hill City, Minn., has been awarded to J. G. Robertson, St. Paul, at $10,990.

The contract for constructing a water system at Durand, Wis., has been awarded to F. C. Robinson & Co., Mantitowoc, at $20,000.

The contract for constructing a water system at Durand, Wis., has been awarded to F. C. Robinson & Co., Manitowoc, Wis., at $20,000.

WEST OF THE MISSISSIPPI

The Guttenberg Canning Co. has secured the Rodenberg Block, at Dubuque, Iowa, and will build a factory.

Bennett Bros., manufacturers of farm-dairy apparatus, will build a factory, at Owatonna, Minn.

The contract has been awarded for the construction of a six-story addition, 66x132 ft., to the Eggerss-O'Flyng box factory at Fifteenth and Leavenworth Sts., Omaha, Neb., at $47,000.

The A. Allison Co., of Cardwell, Mo., will build a band-saw mill with a capacity of 50,000 ft. of lumber per day, at Gideon.

The Missouri Stair Co., 684 Maple Ave., St. Louis, Mo., has bought a lot on Forest Park Boulevard, near Spring Ave., on which it will build a new factory. It will be a two-story building, 60x190 ft.

F. W. Harrison, St. Louis, Mo., represents a company capitalized at $100,000, which intends to construct a hardwood mill, at Trinity, Tex.

S. Q. Sevier and A. L. Morgan are planning to build a cotton mill, at Camden, Ark.

J. W. Embrey will build a broom factory at Brady, Tex., for the manufacture of brooms.

The plant of the Ennis Overall & Glove Co., Ennis, Tex., was destroyed by fire, Mar. 20. Loss, $14,000.

The Industrial Cotton Oil Co., Houston, Tex., will rebuild its plant on the North Side, recently destroyed by fire. The new plant, including machinery, will cost about $300,000.

W. E. Anderson, Trinidad, Colo., is considering the purchase of a site in Denver for a wagon factory.

WESTERN STATES

The McVoy Tub, Pail & Package Co., Minneapolis, Minn., plans to erect a branch plant, at Bellingham, Wash. M. McVoy is president.

The plant of the Chippewa Lumber Co., Lake Ballinger, Wash., was damaged by fire to the extent of $30,000. It is understood that it will be rebuilt.

The Stimson Mill Co., Seattle, Wash., will make extensive improvements in its lumbering plant. New electrical appliances and motors will be installed.

The shingle-mill plant of the Kanasket Shingle Co., Shelton, Wash., was partially destroyed by fire. Loss, $10,000.

It is reported that W. M. Roveland, secretary of the Kalamazoo Paper Co., Kalamazoo, Mich., is considering plans and locations for the construction of a new mill in Tacoma, Wash. The estimated cost of the work is $500,000.

The Acme Cement & Plaster Co., St. Louis, Mo., will erect a gypsum-cement plaster manufacturing plant at Baker, Ore., to cost $200,000. It will a three-story steel structure.

The plant of the Grants Pass Cold Storage & Ice Co., Grants Pass, Ore., has been practically destroyed by fire. Loss, $15,000.

W. H. Goodenough, Hood River, Ore., is contemplating the erection of a paper factory there.

The Portland Ry., Light & Power Co., Portland, Ore., will erect machine and car shops on its grounds between East Seventeenth St. and the grounds of the Southern Pacific Co., Mall and Center Sts., to cost $400,000.

The Algoma Lumber Co., Klamath Falls, Ore., will erect a sawmill plant and box-making plant, at Rattlesnake Point.

The city of Coronado Beach, Calif., is considering the construction of a garbage incinerator, to cost about $7000.

The Concrete Brick & Tile Co., Fresno, Calif., will erect a plant for the manufacture of patented brick and tile. J. E. West, Visalia, Calif., and W. W. Welch, Fresno, are proprietors.

The Van Nuys Building Co. has awarded the contract for power-plant equipment in the 11-story building at Seventh and Spring Sts., Los Angeles, Calif., at $26,543.

The Pacific Coast Carbon Co., Oakland, Calif., a newly incorporated concern, will erect a factory in Oakland. It will be of brick, 40x300 ft.

A canning factory to cost $20,000 will be erected in Porterville, Calif., along the Southern Pacific tracks. F. U. Nofziger, Porterville, is interested.

The California Ramie Co., San Francisco, Calif., will erect a fruit-crushing plant at West Berkeley, Calif. Grinding machinery will be installed. H. H. Howard is manager.

Richardson & Fisher, San Diego, Calif., will erect a tile-manufacturing plant.

CANADA

Plans are being perfected by the Colonial Whitewear Co., Guelph, Ont., for the erection of a knitting factory for the manufacture of knitted cloths for suits. W. H. Moore is president and manager.

Benson & Bray, manufacturers of doors, sashes and mouldings, Midland, Ont., plan to improve their plant. A new two-story building, 165x70 ft., a boiler room, and a dry kiln, 20x52 ft., will be erected. The estimated cost is $46,000.

The East End car barns of the Toronto Ry. Co., Toronto, Ont., were destroyed by fire, Mar. 25. Loss, $500,000.

Woodville Grist Mill, Woodville, Ont., was destroyed by fire, Mar. 17. Loss, $8000, partly covered by insurance.

NEW INCORPORATIONS

METAL WORKING

The H. Koppers Co., Portland, Maine, has been incorporated with a capital of $500,000 to manufacture and deal in machinery, tools and appliances for the manufacture of coke, charcoal, iron and gas. C. E. Eaton is president and T. L. Croteau is treasurer.

The Schlich Coin Counting & Wrapping Machine Co., Kittery, Maine, has been incorporated with a capital of $150,000 to manufacture and sell coin-counting machines. L. B. Swett is president and G. E. Burnham, treasurer.

The Gas & Electric Demonstrator, Inc., Stamford, Conn., has been incorporated with a capital of $350,000 to manufacture electric appliances. The incorporators are Darton L. Babcock, A. E. Peat and H. M. Smith, of New York.

The Adams Gas Engine & Tool Co., Greenwich, Conn., has been incorporated with a capital of $50,000 to manufacture gas engines and electrical machinery. The incorporators are C. F. Waterbury and H. Weed, of Stamford, and W. H. Adams, of Greenwich.

The Gridley, Fuhrman & Martin Co., Elmira, N. Y., has been incorporated with a capital of $40,000 to manufacture and deal in hardware and hardware supplies. The incorporators are C. H. Gridley, H. K. Fuhrman and B. E. Martin.

The Buffalo Electric Vehicle Co., Buffalo, N. Y., which is a merger of five automobile concerns, has been incorporated with a capital of $1,000,000 to manufacture pleasure and commercial vehicles. The incorporators are W. J. P. Seipp, W. C. Feuchter and Thomas B. Wheeler, all of Buffalo.

The Federal Chain & Manufacturing Co., Brooklyn, N. Y., has been incorporated with a capital of $150,000. Mechanical engineers, machinists and tool makers. The incorporators are P. T. Hamm, S. Nobis, Brooklyn, and T. Costello, New York, N. Y.

The Parker Supply Co., New York, N. Y., has been incorporated, with a capital of $25,000, to manufacture sheet-metal products. The incorporators are A. Blumlein, Bronx, N. Y.; R. Sadwith, New York, N. Y., and C. Berlin, Brooklyn, N. Y.

The Little Giant Electric Co., Manhattan, N. Y., has been incorporated, with a capital of $100,000, to manufacture electrical and magnetic machinery. The incorporators are L. T. Noonan, A. D. F. Randolph, New York, N. Y., and C. Swanson, Brooklyn.

The Waddell Manufacturing Co., Paterson, N. J., has been incorporated with a capital of $100,000 to manufacture metal shapes in copper, brass, aluminum and cast iron. The incorporators are M. Waddell, New York, N. Y.; E. P. Cooke and C. D. Cooke, Paterson.

The Atlantic Vehicle Co., Jersey City, N. J., has been incorporated with a capital of $340,000 to manufacture all kinds of vehicles. The incorporators are M. Black, L. R. Jillson, New York, N. Y., and J. R. Turner, Basking Ridge, N. J.

The James S. Griffin Co., Elizabeth, N. J., has been incorporated with a capital of $10,000 to manufacture automobiles. The incorporators are E. M. Scanlon, 667 Madison Ave., A. R. Eaton, Jr., 1155 East Jersey St., and R. L. Eaton, 407 Jersey Ave., all of Elizabeth.

The Rudolph Aëroplane Co., Newark, N. J., has been incorporated with a capital of $125,000 to construct aëroplanes. The incorporators are Frank Baur and Bertha Baur, 48 Winans Ave., and F. W. A. Rudolphi, 67 Howard St., Newark, N. J.

The Anthracite Iron Works, Scranton, Penn. has been incorporated with a capital of $10,000. George F. Becker is treas.

The Delaware Leather Machinery Co., Wilmington, Del. has been incorporated with a capital of $100,000. Incorporated by M. M. Dugan.

The Philipp-Kell Co., Baltimore, Md., has been incorporated, with a capital of $10,000, to manufacture metal goods. The incorporators are Edgar C., Ernest A. and Henry Philipp, of Baltimore, Md.

The United Sign Manufacturing Co., Rome, Ga., has been incorporated, with a capital of $25,000, to manufacture signs. The incorporators are C. S. Sparks, Rome; Frank Sparks, Chattanooga, Tenn., and C. E. Thurmon, Los Angeles, Cal.

The Standard Electric Tool Co., Cincinnati, Ohio, has been incorporated with a capital of $10,000 to manufacture electrical tools. The incorporators are F. N. Kunkle, E. W. Griffin and H. L. Aicholz.

The W. L. Cotton Co., Dayton, Ohio, has been incorporated for $15,000 to manufacture electric-light, power and heating equipment. The incorporators are W. L. Cottom and M. E. Powell.

The Empire Automobile Co., Indianapolis, Ind., has been incorporated with a capital of $100,000 to manufacture automobiles. The incorporators are C. E. Gibson, C. B. Sommers, Indianapolis, and A. Waldheim, St. Louis.

The Wilkinson Motor Starter Co., Detroit, Mich., has been incorporated with a capital of $50,000 to manufacture self-starters for automobiles. The incorporators are B. E. Brown, 14 Hague Ave., and R. S. Brown, 136 Westminster Ave., Detroit.

The Chicago Electric Motor Car Co., Chicago, Ill., has been incorporated with a capital of $110,000 to manufacture automobiles and accessories. The incorporators are David F. Rosenthal, Leo S. Kostchek and J. L. Gossman.

The Schaeffer & Budenberg Manufacturing Co., Chicago, Ill., has been incorporated with a capital of $20,000 to manufacture and deal in mechanical instruments. The incorporators are R. E. Bultman, F. E. Wright and R. J. Smack.

The Phillips Gasoline & Kerosene Engine Co., Chicago, Ill., has been incorporated with a capital of $6500 to manufacture engines, machinery and tools. The incorporators are L. C. Kuhnert, Jr., S. Adler and H. L. Weiss.

The Kersten Co., 427 West Randolph St., Chicago, Ill., has been incorporated, with a capital of $30,000, to manufacture brass goods. The incorporators are Charles E. Kersten, William A. Kersten and Francis H. Hammett.

The Western Pattern & Manufacturing Co., Moline, Ill., has been incorporated with a capital of $100,000 to manufacture patterns and machinery. The incorporators are C. S. Atkinson, E. W. Meyers and T. L. Barnes.

The John Neumaier Electric Co. Streator, Ill., has been incorporated with a capital of $10,000 to manufacture electrical supplies. The incorporators are John Neumaier, W. Acherman and John G. Lukach.

The Hollar Acetylene Gas Machine Co., Tonica, Ill., has been incorporated, with a capital of $5000, to manufacture gas-generating machines. The incorporators are G. W. Hartenbower, George M. Reynolds and John B. Hollar.

The Black Hawk Manufacturing Co., Waterloo, Iowa, has been incorporated with a capital of $10,000 to manufacture patterns, flasks, iron casting and machinery. The incorporators are E. J. Brady, H. B. Lichty and G. H. Andrews.

The J. I. Case Plow Co., St. Louis, Mo., has been incorporated, with a capital of $2000, to manufacture plows. The incorporators are S. W. Fordyce, Jr., John H. Holliday and Thomas W. White.

The Southern Iron & Steel Co., Beaumont, Tex., has been incorporated, with a capital of $250,000. The incorporators are J. M. McCormick, H. L. Bromberg and Jas. Bowren.

J. C. Vanarsdel & Co., of Dallas, Tex., has been incorporated, with a capital of $50,000, to manufacture machinery. The incorporators are J. C. Vanarsdel, Olin Brooks and L. C. Brooks.

The Power Saws Co., Ogden, Utah, has been incorporated with a capital of $45,000 to manufacture portable power saws. The incorporators are Paul C. Burdick, Wilson T. Robbins and Richard Jessop.

The Union Tool Co., Oleum, Calif., has been incorporated with a capital of $2,200,000 to manufacture and sell tools. The incorporators are Lyman Stewart, W. L. Stewart and Edward Double.

The Railroad Utilities Manufacturing Co., Long Beach, Calif., has been incorporated, with a capital of $125,000. The incorporators are E. C. Green, C. O. Whittemore and F. W. G. Phillips.

The Crown City Garage Co., Los Angeles, Calif., has been incorporated, with a capital of $25,000. The incorporators are Charles Wood, J. G. Dickey and J. A. Parberry.

The Morrow-Mercury Motor Car Manufacturing Co., Los Angeles, Calif., has been incorporated, with a capital of $20,000. The incorporators are J. B. Morrow, Paul Brown, Jr., and O. B. Hutchings.

The Waltman Pump Co., Taft, Calif., has been incorporated with a capital of $100,000 to manufacture pumps. The incorporators are J. A. Waltman, Bakersfield; C. J. McDivitt, Randsburg, and J Walter Key, Taft, Calif.

The Fire Protection Equipment Co., Toronto, Ont., has been incorporated, with a capital of $50,000, to manufacture fireproof doors and windows and metal lath. The incorporators are George D. Perry, Sidney B. McMichael and Stanley V. L. Wilmot.

Forthcoming Meetings

American Society for Testing Materials. Annual meeting, New York City, Mar. 28-29. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

National Metal Trades Association. Fourteenth annual convention, Apr. 11, Hotel Astor, New York City. Robert Wuest, commissioner, New England Building, Cleveland, Ohio.

American Supply and Machinery Manufacturers' Association, National Supply and Machinery Dealers' Association, Southern Supply and Machinery Dealers' Association. Triple convention, May 13-15, Norfolk, Va., Hotel Monticello. F. A. Mitchell, secretary, 309 Broadway, New York City.

Master Boiler Makers' Association. Sixth annual convention, Fort Pitt Hotel, Pittsburg, Penn., May 14-17. J. Rogers Flannery, secretary arrangements committee, Flannery Bolt Co., Pittsburg, Penn.

National Machine Tool Builders' Association. Semi-annual convention, May 16-17, Atlantic City, Hotel Chalfonte. Charles E. Hildreth, secretary, Worcester, Mass.

American Society of Mechanical Engineers. Spring meeting, May 28-June 1. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

American Railway Tool Foremen's Association. Annual convention, Chicago, Ill., July 9, 1912. H. L. Mills, secretary, 835 Monadnock Building, Chicago, Ill.

American Society of Engineer Draftsmen. Regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies Building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton Building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Connecticut

WANTED — Six first-class pattern makers, familiar with heavy machinery work. Farrel Foundry & Machine Co., Ansonia, Conn.

FOREMAN—Thoroughly competent for head of planer department, who is conversant with modern planing methods; references required. The Whitlock Printing Press Mfg. Co., Derby, Conn.

A MAN experienced in cold-rolling spring steel in all gages from 0.003 up to ⅜ in. and drawing spring wire; must know what equipment is necessary and how to install same. Address P. O. Box 941, New Haven, Conn.

Indiana

FOREMEN, also production manager for large automobile factory; must be thorough mechanic in automobile manufacture, possessing executive ability of highest order; want foremen for first and final assembly and machine departments; state age, experience, references, salary wanted. 218 State Life Building, Indianapolis, Ind.

Maryland

DRAFTSMAN, experienced on high-speed stationary engines. Box 112, Am. Machinist.

DRAFTSMEN, experienced on dredging machinery and marine work; also competent structural and hull draftsmen. Box 59, Am. Machinist.

Massachusetts

TOOL DESIGNERS, experienced; specialty on jigs and fixtures; state experience and wages expected. Apply Employment Department, General Electric Co., Pittsfield, Mass.

DRAFTSMAN, experienced with electrical or high-speed steam-engine experience for a permanent position with a large manufacturing concern near Boston, Mass. Apply stating age, education, experience and salary expected by addressing "Chief Draftsman," Box 139, Am. Machinist.

SUPERINTENDENT for an established manufacturing plant making fine tools in New England; must be superior experienced American mechanic, tool maker and designer; capable of managing 200 skilled machinists; salary, $2000 to $4000; buildings, equipment, power, costs, etc., are handled by the manager. Box 81, Am. Machinist.

ENGINEER-COST ACCOUNTANT—We wish to secure the services of a technical graduate who has had experience in industrial plants, preferably machine shops, since leaving college, and who understands from some practical experience the application, as well as the theory, of double-entry bookkeeping as applied to cost-accounting practice; applications should be as complete as possible, stating age, nationality, some account of college record, and specific details of subsequent experience. Clinton H. Scovell & Co., certified public accountants—industrial engineers, 40 Central St., Boston.

Michigan

OPERATORS—We are frequently needing good operators for turrets and gear cutters, principally Jones & Lamson and Gleason, and invite applications. Frost Gear & Machine Co., Jackson, Mich.

FOREMAN machine room, at once by Michigan manufacturer in fine town of six thousand people; this shop makes mostly small brass parts, also priming cups, gasoline stop cocks, etc.; only first class, married man wanted, one familiar with ground key work preferred, but not absolutely required; in answering state wages wanted and give references. Box 109, Am. Machinist.

Minnesota

FOREMAN, high-grade, first-class, for machine-tool department of modern plant in general manufacturing line. Address F. E. Harris, 725 Eighteenth Ave., North, Minneapolis, Minn.

Missouri

DRAFTSMAN on general machinery, who has designing ability; give experience and salary expected. Box 130, Am. Machinist.

New Jersey

DESIGNER on tools and machinery for small interchangeable parts. Box 73, Am. Machinist.

DRAFTSMAN; one who is accustomed to subpress and pillar die work, jigs, fixtures and small automatic machinery; permanent position to right man; factory located in Newark, N. J. Box 137, Am. Machinist.

New York

MECHANICAL DRAFTSMAN, who is familiar with gas-engine design, both two- and four-cycle horizontal type; give experience. McEwen Bros., Wellsville, N. Y.

FOREMAN for automatic and turret lathe department; must be a hustler, thoroughly experienced and able to produce accurate work at the proper cost; steady position for the right man. Box 150, Am. Machinist.

MECHANICAL DRAFTSMAN or man experienced in general machine work; give experience and wages wanted. McEwen Bros., Wellsville, N. Y.

Ohio

SALESMAN, experienced, for Middle West, competent to furnish estimates and negotiate sales for presses, dies and equipment used in manufacturing sheet and bar-metal products; experienced men only need apply. Box 71, Am. Machinist.

MACHINE DESIGNER of automatic machinery; only those with broad experience and capable of holding position of chief designer need apply; state age, experience and present salary in first letter. Box 140, Am. Machinist.

MECHANICAL DRAFTSMAN, at once, by Ohio manufacturer, who has had automatic-engine experience and who is thoroughly familiar with strength of materials and automatic engines of the single and four-valve types; replies must give full details of experience and salary desired and will be treated strictly confidential. Box 69, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

INSPECTOR, at once, by Ohio manufacturer; man experienced in automatic engines of the single and four-valve types to act as inspector, and if necessary, foreman of machine work and erection; replies must give full particulars of experience, salary desired, etc., and will be treated strictly confidential. Box 70, Am. Machinist.

Pennsylvania

SUPERINTENDENT for plant manufacturing engines and boilers; 200 hands. Address "Dixie," Am. Machinist.

TOOL MAKER, first-class, experienced; small shop employing 20 men; must be capable of taking charge of shop as foreman. Box 138, Am. Machinist.

TOOL DESIGNERS for jigs, fixtures and special tools. Address the employment office of Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

DIE MAKERS, gage makers, jig makers and die setters. Address employment department, Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

TOOL MAKERS—Several first-class tool makers, experienced on small, accurate die work; state experience and salary wanted. Box 811, Am. Machinist.

OPERATORS—Several Acme automatic screw machine operators, tool makers and gage makers. Address employment department, Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Positions Wanted

Connecticut

TOOL MAKER, competent; technical education; 10 years' experience on tools, dies, automatic machines; speedy; good designer; able to handle men; wish to change. Box 110, Am. Machinist.

DESIGNER, tool and machine; technical mechanic; graduated; eight years' experience on automatic machines, tools and dies; speedy calculator, logarithms and slide rule. Box 111, Am. Machinist.

Kentucky

I WANT good responsible job, either on the road or in the house; have had 18 years' experience in factory, mill supply, foundry and machine shop business, from office boy to manager. Address "Job," Am. Machinist.

Massachusetts

CHIEF INSPECTOR—Competent man on machine tools and parts; thoroughly up to date and experienced in modern manufacturing methods. Box 141, Am. Machinist.

SUPERINTENDENT, assistant superintendent or general foreman; technical graduate, 17 years' practical experience, 12 years with one of the leading up-to-date companies of New England as foreman and department superintendent. Box 142, Am. Machinist.

New Jersey

ASSISTANT SUPERINTENDENT desires to make change; up to date on high-speed steel, speeds and feeds; understands piece work and premium system; wish to connect with factory that desires to increase their output at a minimum cost; will accept any of the following positions: Productive engineer, superintendent, or general foreman; a good executive and a man of ability and originality; will furnish references. Box 147, Am. Machinist.

New York

MECHANICAL DRAFTSMAN, various experience, wishes position. Box 119, Am. Machinist.

DESIGNER, experienced in designing special and automatic machinery, wants position. Box 483, Am. Machinist.

GENERAL FOREMAN, thoroughly acquainted with rapid production, wants position. Box 131, Am. Machinist.

SUPERINTENDENT or foreman; practical all-round mechanic; general and special machines, tools, dies and jigs, also designing. Box 145, Am. Machinist.

DRAFTSMAN, age 23, machine-shop experience, would like position as draftsman or assistant to foreman, where there is a chance for advancement. Box 146, Am. Machinist.

FOREMAN—Practical japanner and enameler, now employed as foreman, desires change; typewriters, adding machines or metal furniture preferred. Address "E. E. W.," Box 19, Madison Sq. Branch, New York.

DESIGNER, technical graduate, 29; ten years' experience automatic and general machine design, also experimental work and shop practice, desires position as assistant engineer or superintendent. Box 143, Am. Machinist.

SALESMAN, office manager, experienced in cost keeping, shop accounting, buying and selling; 32 years old; would prefer salesman's position; have years of experience in various kinds of special machinery. Box 152, Am. Machinist.

MECHANICAL SUPERINTENDENT, large technical and practical experience in designing, erecting and running a plant, build and improve special and labor-saving machinery, good executive, is desirous of making a change to broader field where opportunity to show exceptional ability would be offered and appreciated; prefer New York; age 33, married. Box 136, Am. Machinist.

ESTIMATOR and salesman; expert on dies, power presses, sheet-metal work and light manufacturing; thoroughly practical, educated and reliable; knows the game from raw material to sales office; holds A1 subordinate position at present and would like to change about July 1 to become principal in a broader selling field; age 35; married; references, reputation and record unusual; salary, $50. Box 144, Am. Machinist.

DRAFTSMAN—15 years' experience on machine tools, hydraulics, elevators, transmission and electrical machinery; exceptional ability on practical development of automatic machinery for cheap production of parts, labor-saving devices and a thorough knowledge of modern production methods; a position is wanted with some wide-awake manufacturing concern where this ability is taxed to the utmost; a comparatively low salary is asked only where a permanent position with unlimited opportunity for advancement is offered. Box 148, Am. Mach.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

TOOL DESIGNER, college graduate, 10 years' shop and office experience automatics, special machines, jigs, desires change; best references. Box 151, Am. Machinist.

Pennsylvania

MECHANICAL SUPERINTENDENT, expert mechanic, engineer, wants to make good connection; moderate salary. Box 95, Am. Machinist.

ENGINEERING or sales position with manufacturer of power or railway apparatus; applicant is 38 years of age, has technical education and practical training as mechanical electrical engineer and five years' experience on transportation work; can install and operate steam and gas engines or electric motors; thoroughly conversant with electric-car equipment and operation; at present employed but desire more active position. Box 134, Am. Machinist.

Rhode Island

SUPERINTENDENT, general foreman; have unit times tabulated; A1 results for A1 salary. Box 121, Am. Machinist.

Wisconsin

SUPERINTENDENT or assistant; 20 years of practical shop experience; thorough practical knowledge of piece work and premium systems and uptodate methods of manufacturing duplicate work at a minimum cost; at present employed in responsible position. Box 132, Am. Machinist.

Miscellaneous

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Technical Patents. G. M. Sacerdote, M. E. and P. A., 1919 Broadway, N. Y.

Broken machinery welded and guaranteed. Waterbury Welding Co., East Waterbury, Conn.

Production increased, quality improved. James F. Hobart, efficiency engineer, Box 133, Am. Machinist.

For Rent—Two-story brick factory, 7500 sq.ft., Plainfield, N. J. A. J. Brunson, Plainfield, N. J.

Machine shop in New England, fully equipped, wants to contract for small, light machinery; good foundry facilities and can turn out work quickly. Box 153, Am. Machinist.

Have a thoroughly equipped shop for production of interchangeable parts; stamping, forming, screw-machine work; send blueprints of requirements. B. Morgan, Newport, R. I.

Machine shop for sale in New England, manufacturing a standard line of well known machine tools; we own the buildings and lot, 75x150 ft., and are a going concern. Box 154, Am. Machinist.

For Sale or Rent—In village of Albion, substantial stone building, 50x127 ft., from street to barge canal; well adapted for foundry and machine shop; no foundry within 10 miles or more; good location for business. G. H. Church, Bergen, N. Y.

For Sale—One 4¼ Cleveland automatic machine, also one 2¾ Cleveland automatic, and one No. 1 Brown & Sharpe universal grinder, in first-class condition. Address The Standard Machinery Co., Mystic, Conn.

Machine shops and foundries desirous of manufacturing and marketing a profitable specialty, in the line of fixture, device or machine requiring but little capital, should communicate with the Engineering Service Co., Box 463, Williamsport, Penn.

Machinists—Do you want to earn a day's pay during the noon hour? We are offering big inducements to hustlers in every machine shop in the country; a bonafide business proposition; no triflers need apply; write for particulars. Alert Tool Co., 221-223 N. 23d St., Phila., Penn.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

For Sale—Atherton Machine Co.'s plant, manufacturing a line of special silk and textile machinery, also a miscellaneous local business; well equipped machine, blacksmith, pattern and woodturning shops and iron foundry; heirs wish to sell; an exceptional opportunity for a live man. Box 149, Am. Machinist.

Machine tools and small tools—Alfred Herbert, Ltd., Coventry, having an extensive organization and a large staff of salesmen specially engaged on machine tools and small tools in Great Britain, France, Germany, Italy, Switzerland, Belgium, India and Japan, are open to handle good agencies of all kinds and invite correspondence with manufacturers.

Drawings, specifications, estimates and manufacture of jigs, fixtures, automatic machinery, special equipments, punches and dies by a corps of experts; write us your requirements for suggestion of ideas and cost estimates. Laurin & Sundstrom, 271 Hicks St., Brooklyn, N. Y.

Talks With Our Readers

By The Sales Manager

AMERICAN MACHINIST:

I have often wondered if others read the selling section of the AMERICAN MACHINIST as carefully as I do.

Recently I learned through an interesting experiment that such is the case, and that the majority of the foremen, at least in the place where I am employed, make a remarkably close study of the advertisements. How I demonstrated this to my own satisfaction will appear below.

To thoroughly explain, it will be necessary to digress a little and to relate how the idea came to me.

Some time ago I attended an evening party where, among other devices for the amusement of the guests, there was held what was called "an advertising guessing contest." On a large placard were pasted the trademarks, advertising devices or mottoes of well known firms, cut from the magazines, with the name of the firm omitted. There was the universally recognized "His Master's Voice" of the Victor Phonograph Co., "The Blue Bell" of the Bell Telephone Co., "Phoebe Snow," of the D. L. & W. R. R. Co. and others, known in every household. Persons guessing most of the names of the firms to which these devices appertained were awarded prizes, and the results were startling. Nearly everyone seemed to recognize them at sight.

So I said to myself, "You must be wrong in thinking that the readers of technical papers don't read the ads. for if these persons read the advertising pages of their monthly magazines, surely your associates in the shop read their ads. too."

I determined to try this for myself and settle the question to my own satisfaction, and not long afterward at the annual dinner given by the firm to the foremen, I asked permission to arrange a somewhat similar device, cutting the illustrations from the AMERICAN MACHINIST.

So we hung a placard on the wall with a cut of "Bill" of the Coates Flexible Shaft, of the broken test block with an "Allen" hollow set screw in it, the big nut with "Quality, Finish," etc., on it, of the Milton Mfg. Co., the X star F of the Nicholson File Co., the big cutter of the Barber-Coleman Co., with the name rubbed off, and other well-known symbols and trademarks which appear in the AMERICAN MACHINIST, and the men were provided with pads on which to write the names of the firms represented. Well, we had a hard time to decide to whom the prize should go. There were more correct lists than otherwise, and so I changed my ideas regarding the reading of advertisements through having a graphical demonstration.

Now, there was one other thought impressed upon me, and that is the fact that so few, comparatively, of the hundreds of firms who advertise their products in the AMERICAN MACHINIST, have any trade mark, symbol or device to attract attention and single them out from others of the same class, and have nothing but their name to attract attention. I refer more particularly to the smaller ads. which are grouped together on one page. For instance, on one page of the advertising selling section are shown the ads. of a number of gear companies, practically all illustrated by the cut of a gear, and nothing else.

Now, would it not be for the better if one of these firms would break away from the others and use a cut likely to arrest attention and single their ad. out, even when placed in the middle of a page of others and thus by its very novelty command perusal?

In conclusion, I would say to those that pass the advertisements by with only a careless glance, that they do themselves a great injustice and cannot hope to stay in the front rank if they do not imitate their more progressive brethren and keep posted in this manner.

J. CARD, Akron, Ohio.

* * *

Only reliable products can be continuously advertised.

The Westinghouse Air Brake Shops

By Ethan Viall

The principal shop operations on air and pump cylinders, and hose couplings.

Special milling, turning, drilling and tapping machines of unusual design.

The shops of the Westinghouse Air Brake Co., Wilmerding, Penn., are remarkable in many ways. In the first place, out of about 3500 men employed, over 250 have been with the company for at least 21 years, and one man has been with them 43 years, which speaks volumes for the excellence of the management and shop conditions.

Every possible precaution is taken to safeguard the men, not only in the matter of mechanical safeguards of every description, but also from a hygienic standpoint as well; the entire plant is sprayed each week with the best anti-tuberculosis solution obtainable. A well equipped hospital with attendant physicians is in a convenient location to take care of all emercency accidents, though owing to the great care exercised throughout the plant, these are less than usual in a shop of this size. Suggestions are welcomed from the employees on all subjects.

Piecework is almost universal in the shop and hand feed is used wherever possible, as it is considered quicker and more satisfactory on reasonably small work than power feed, permitting an experienced operator to crowd his tools according to the nature of the metal being cut, and making allowances for hard or soft spots that are impossible with power feed. Many of the machines or attachments in use have been especially made, either in the shop or from designs furnished by the company's engineers, though standard machines are used wherever possible.

The first of the articles descriptive of the shop practice of this company will deal principally with some of the machining operations on the heavier parts used in air-brake construction.

Machining Air Cylinders

The first shop operation on air cylinders is to place them, five at a time, in a fixture on a Beaman & Smith three-head miller, as shown in Fig. 1, and rough off both ends and the back rib. It will be noted that the fixture used is made in sections, each section accommodating a cylinder, so that as many sections may be placed on the machine as the table will take. They are also handled much more easily than when made in one piece as is sometimes the case. After being milled, the air cylinders are rough and finish bored in a Sellers machine, as shown in Fig. 2. They are then placed on a special mandrel, and the ends turned in a lathe.

Valve Hole Machine

The valve holes are bored, counterbored, faced and tapped in the double-head, multiple-spindle machine, shown in Fig. 3. The cylinder is placed between the plates *A* and *B* of the fixture and clamped in place by cross-bolts. Guide bushings are provided in these plates, into which the collars *CCC* on the tools fit, so that an unevenly cored hole will not throw them out of line. An air hoist is conveniently located over the machine at *D* for handling the cylinders. Careful gaging and inspecting of all parts is, of course, carried on along with the machine work.

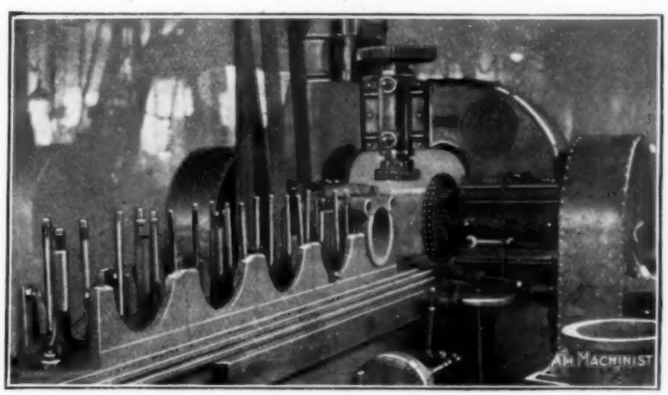


Fig. 1. Three-head Beaman & Smith Miller for Milling Ends and Back of Air Cylinders

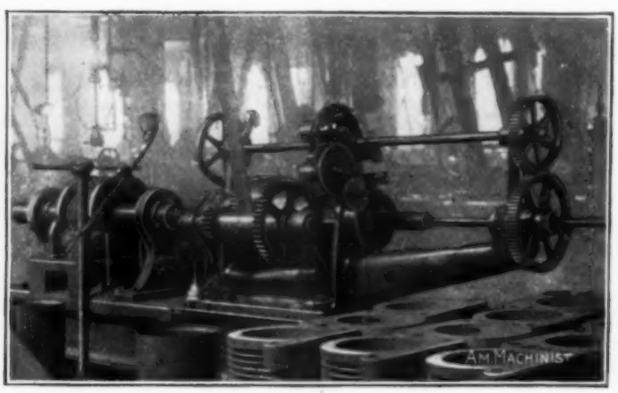


Fig. 2. Sellers Horizontal Mill Boring Air Cylinders

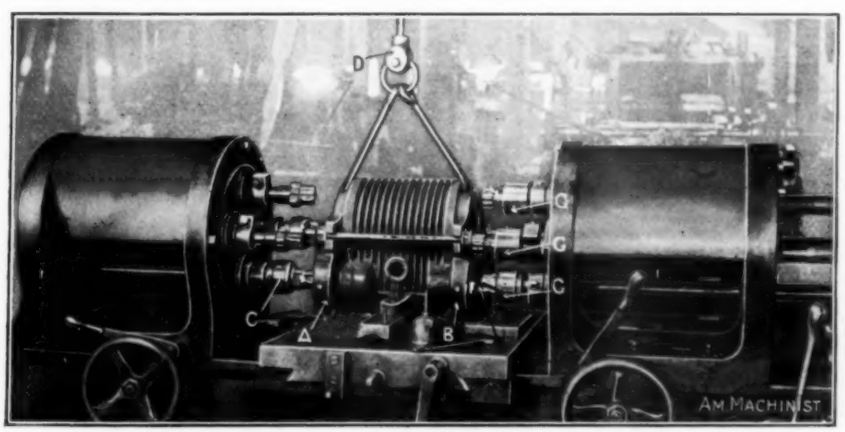


Fig. 3. Boring, Counterboring and Tapping Valve Holes

Boring and Facing Air Reservoirs

The large holes in the ends of air reservoirs are bored out and the ends are faced in the double-turret machine shown in Fig. 4. The reservoir is chucked in the fixture *A*, as shown, the jaws *B*, of which there are four, being operated by set-screws at each end of the jaw. Two of these setscrews are shown at *C* and *D*. The chuck *E* revolves in the heavy, cast-iron strap or ring which holds it, being driven by a shaft and pinion under-

neath. The two turrets are of the ordinary type, carrying regular boring and facing tools and are power fed.

Brake Cylinder Work

Brake cylinders having a heavy back flange are not held in the same kind of a fixture while being bored as are air-pump cylinders, but they are clamped, by

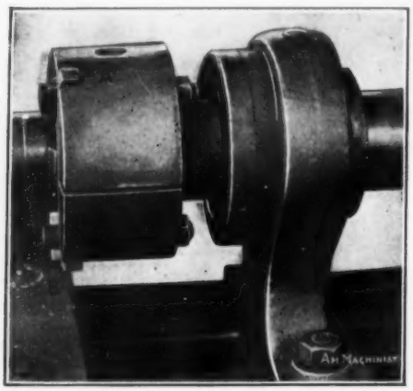


Fig. 6. Type of Boring Head Used on Pump Cylinders

means of the flange, into a fixture as shown in Fig. 5; the fixture, however, remains stationary and the bar travels in both cases. The three-cutter boring head used on these machines is shown in Fig. 6. The cutters, two of which are shown at *A* and *B*, are held in the steel body block by draw-bolts and are set previous to tightening by the gages, using

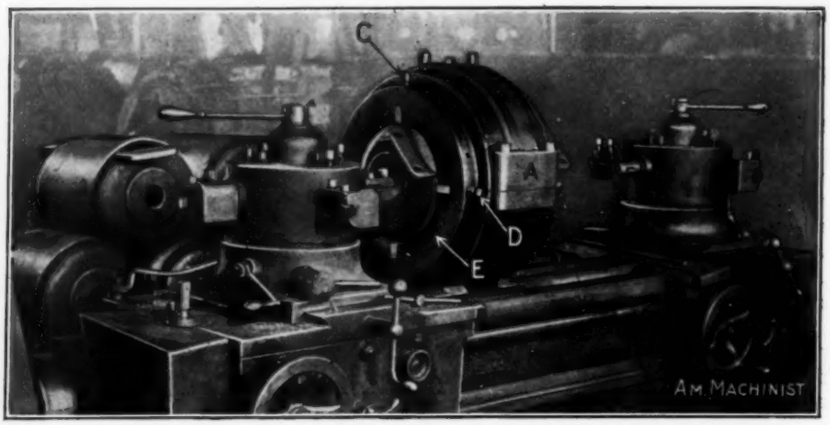


Fig. 4. Boring and Facing Ends of Air Reservoirs

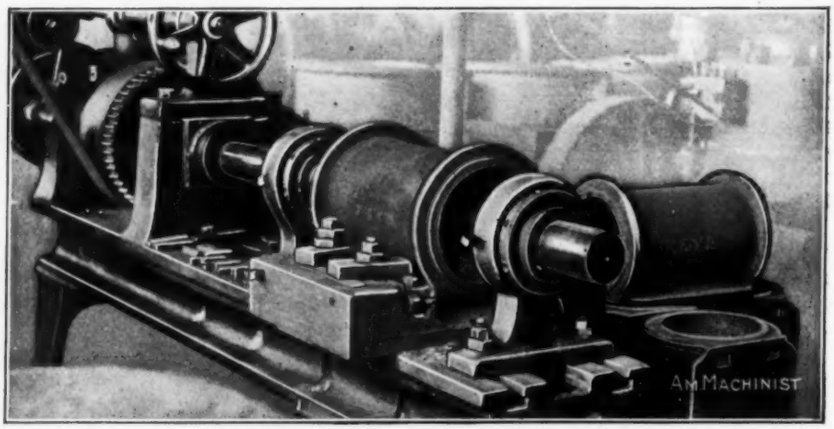


Fig. 5. Boring Pump Brake Cylinders

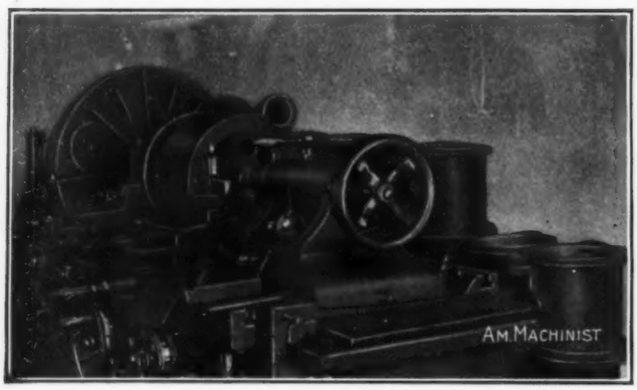


Fig. 7. Facing Ends of Pump Cylinders

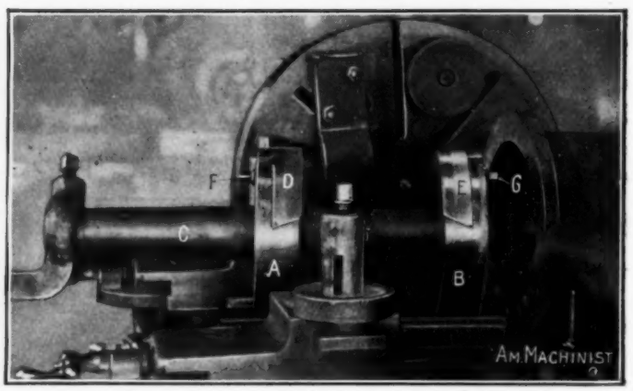


Fig. 8. Mandrel used for Holding Pump Cylinder

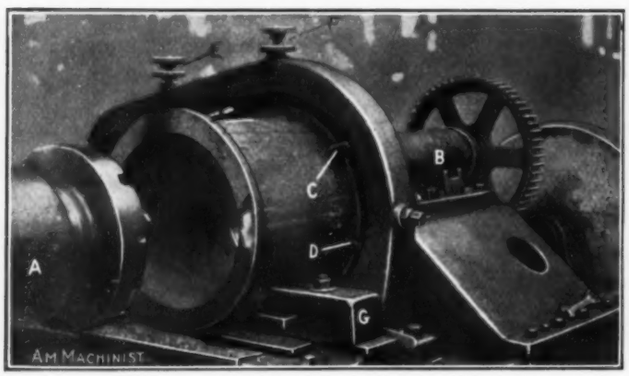


Fig. 9. Double Head Boring Machine used for Cross Compound Pump Cylinders

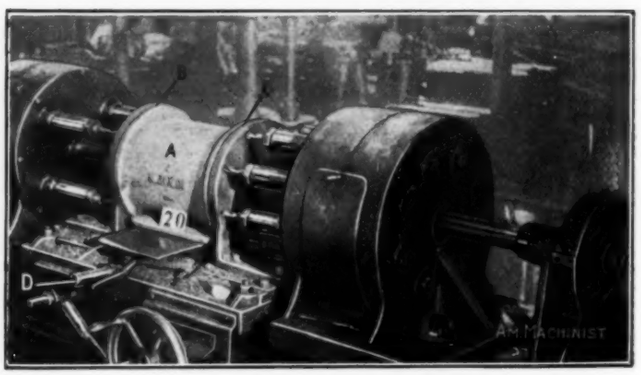


Fig. 10. Drilling Brake Cylinder Flanges

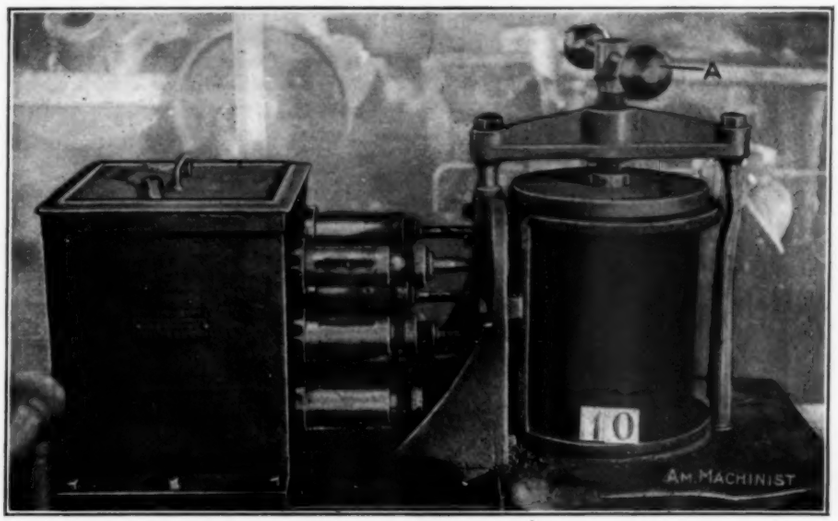


FIG. 11. DRILLING BACK FLANGE OF PUMP CYLINDERS

In this machine the cylinder *A*, to be drilled, is held between two clamping plates *B* and *C*, which are drawn together by means of the hand lever *D*. These plates have bushings inserted in them for guiding the drills, of which in this case, there are eight on the pressure and four on the nonpressure end.

The main spindle of each driller head carries a gear which meshes with a pinion on each separate drill spindle, so that all the spindles in each head move together and are fed in at once. The operation of one of these machines is extremely simple and rapid and a large amount of work is turned out on them.

DRILLING BACK FLANGES

The back flanges of the same kind of cylinders as those just shown, are drilled as shown in Fig. 11, the cylinder being set against stops in the bushed plate and clamped in by running down the handscrew *A* which carries the clamping disk

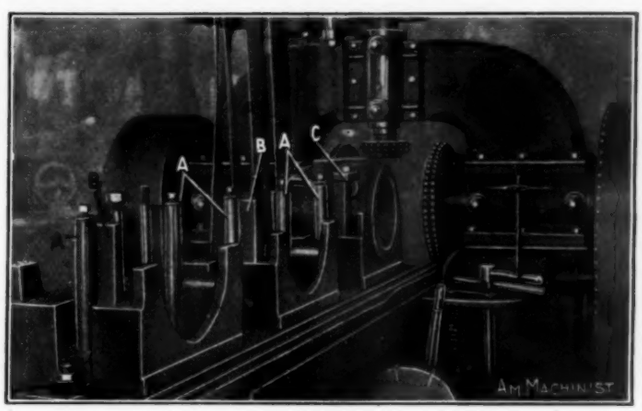


FIG. 12. MILLING BACK AND ENDS OF STEAM PUMP CYLINDERS

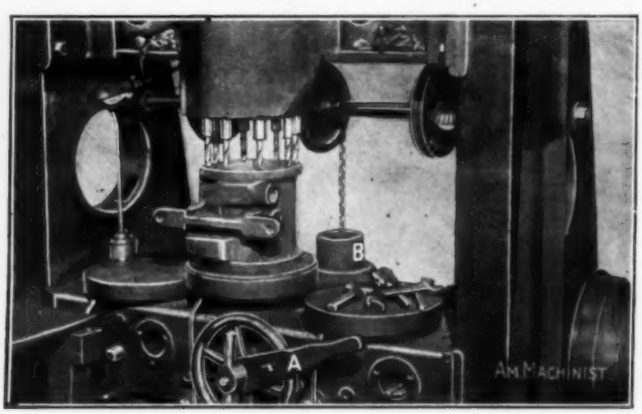


FIG. 13. DRILLING, COUNTERSINKING AND TAPPING STEAM PUMP FLANGES

the boring bar as a base to measure from. A new arrangement of tools will greatly simplify this operation and make these obsolete.

FINISHING CYLINDER ENDS

The ends of pump cylinders, both steam and air, are rough milled, as previously shown, and then finished true with the bore by placing them on a mandrel and truing the ends as shown in Fig. 7. The brake cylinders are finished with a special tool inserted in the boring-mill head, and thus become a part of the boring-mill operation.

FIG. 14. TURNING FLANGES OF NON-PRESSURE BACK HEADS

The type of mandrel used to hold the various cylinders while finishing the ends is shown in Fig. 8. It consists of two disks *A* and *B* mounted on a shaft *C*, the disks having expanding pieces *D* and *E* operated by the setscrews *F* and *G*, the screwing in of which causes the pieces to move outward slightly and lock the cylinder in place.

BORING CROSS-COMPOUNDS

Both cylinders in the castings for cross-compound pumps are bored out at once on the Beaman & Smith two-spindle machine shown in Fig. 9, the head on the spindle *A* boring out the large cylinder and that on *B* boring out the smaller one from the opposite side. The casting is clamped to the holding fixture by hook bolts *C* and *D*, which hook over the flange as shown. Locking setscrews are used on the top at *E* and *F* and a clamp *G* is used on the back flange.

DRILLING CYLINDERS

All flanged cylinders are drilled in practically the same way in multiple-spindle drillers. The drilling of the end flanges of a brake cylinder is shown in Fig. 10.

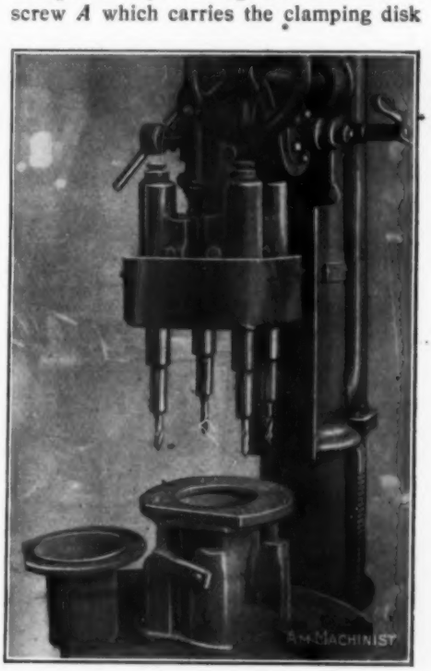


FIG. 15. DRILLING NON-PRESSURE BACK HEADS

B, on its lower end. Six holes are drilled at once in each casting, the machine being double, the operator replacing one casting while the other at the opposite end of the machine is being drilled.

Milling Steam Pump Cylinders

The fixtures used to hold steam-pump cylinders while milling are shown in Fig. 12. They are of the string-unit type, similar to the ones shown for holding air cylinders, though the different shape of these cylinders necessitates another design of locating block. The leveling posts *A* are provided with collared set-screws which are easily turned with the fingers to level the back rib of the cylinder. The cast-iron posts *B*, made solid with the fixture, are also used for the ends of the clamping straps to rest on, as shown at *C*. The other operations on these cylinders are the same as on all the others, though most of the flanges are drilled as shown in Fig. 13.

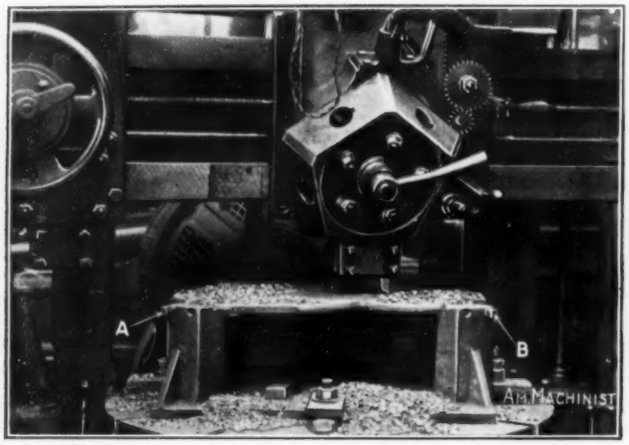


Fig. 16. Facing off Lower Head for Cross Compound Pump

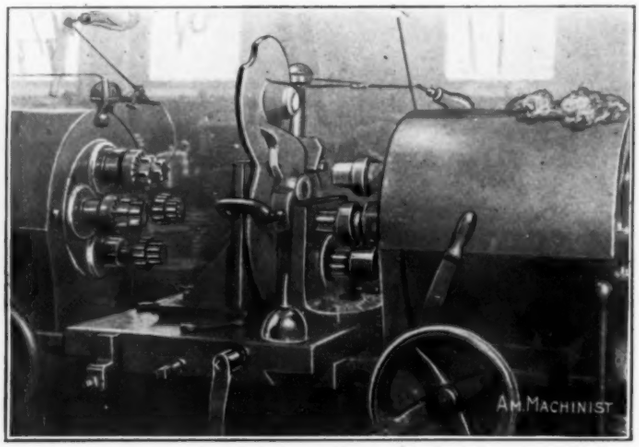


Fig. 17. Boring, Counterboring and Tapping

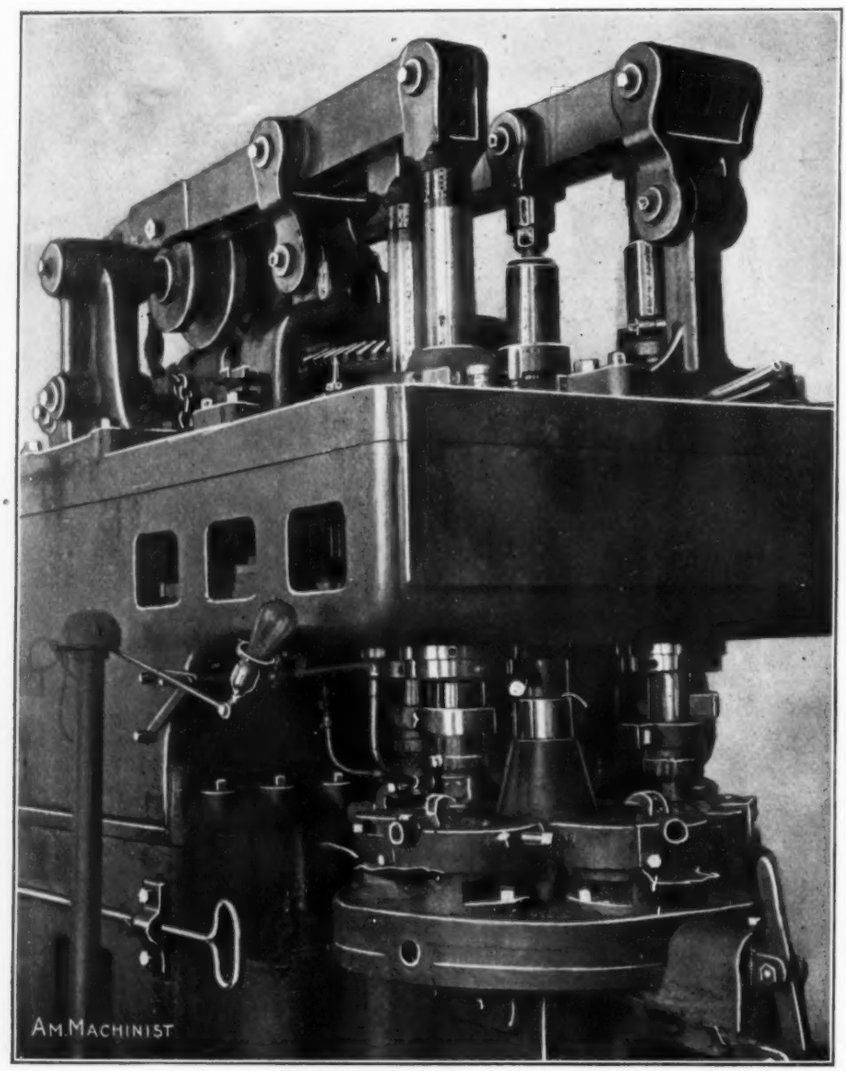


Fig. 20. Special Four-spindle Coupling Machine

This machine originally had three heads but two have been removed and now the drilling, counterboring and tapping are all done with the head shown. The multiple head does not move up or down, but the work is fed to the tools by elevating the table by means of the hand lever *A*, the table being counterbalanced by the weight *B* which makes it easier for the operator to feed up the work.

Fig. 19. Air Hose Couplings, Showing Operations

Turning and Drilling Back Heads

The flanges of back heads are faced and the hole in the small end bored, as shown in Fig. 14. The casting is held in a fixture on the spindle nose and is centered

and held in place by setscrews, part of which are shown at *A*, *B* and *C*, the casting being kept from turning by stops against which the flat side of the flange rests. The facing is done in the regular way by tools on the cross-slide, but the small hole is bored out by a bar held in the tailstock spindle and piloted by a bushing in the head spindle.

After leaving the lathe, four holes are drilled in the flanges of these castings, using an auxiliary multiple head on a regular driller, as shown in Fig. 15. The fixture for holding the castings is exceedingly simple, the casting being set down between the posts of a cast-iron base, clamped to the driller table, the flange resting on top of the posts. The drill jig is simply a bushed ring set on top of the flange and lined up by the flat edge of it. A new arrangement, now contemplated, will greatly simplify this operation, and make the present tools obsolete.

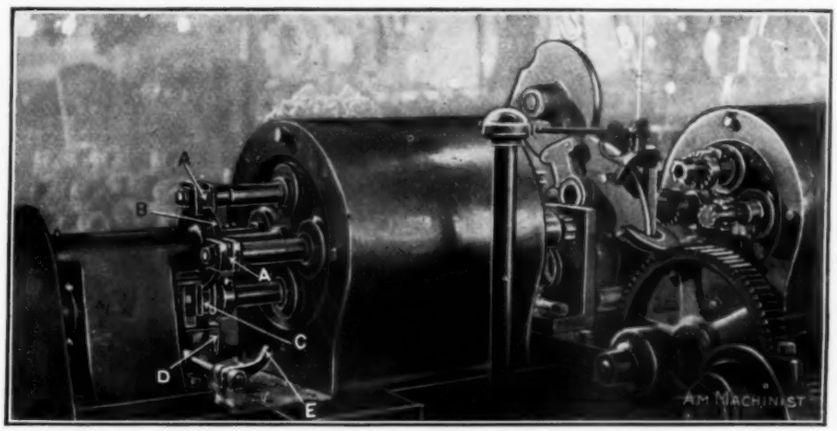


FIG. 18. REAR VIEW OF MACHINE SHOWN IN FIG. 17

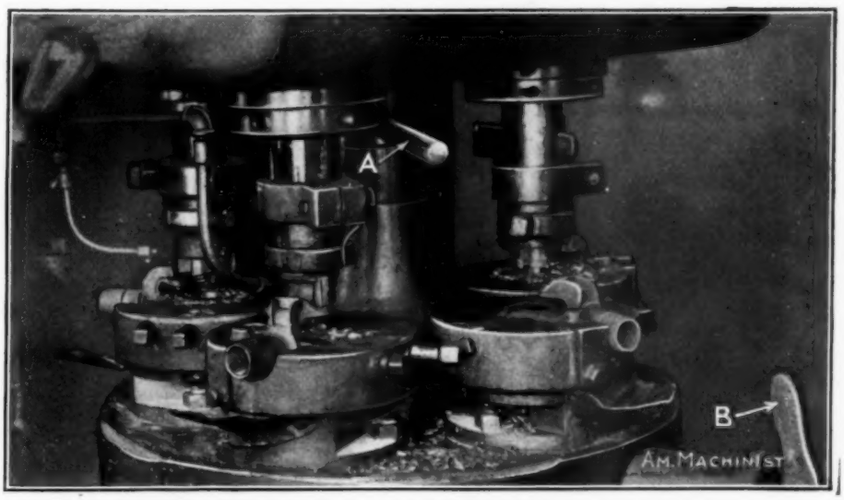


FIG. 21. TOOLS AND REVOLVING TABLE OF COUPLING MACHINE

MACHINING CROSS-COMPOUND HEADS

Both heads of cross-compound pumps are surfaced off in a boring mill as shown in Fig. 16, the head simply being laid in the fixture and clamped in by setscrews as at *A* and *B*. The holes in the upper heads are bored, counterbored and tapped in the machine shown in Fig. 17, only one head of the machine being used. A rear view of this machine is shown in Fig. 18 and the method used to feed the lowest spindle in the turret forward while the rest are held stationary, is plainly illustrated.

These spindles carry the grooved blocks *A* on the end opposite the cutting tools and when not at the lowest point these grooved blocks slide on the disk *B*, but when the turret revolves so as to bring a spindle to the lowest point, the block on the end of it is opposite a space in the disk and in mesh with a clutch on the feeding bar at *C*. As the bar and spindle feed forward the finger *D* strikes the trip *E* and throws out the feeding mechanism, which is then reversed and the turret indexed to the next spindle.

MACHINING HOSE COUPLINGS

The various operations on hose connection castings are shown in Fig. 19. First they are surfaced off at *A* in two cuts, a roughing and a finishing; then they are faced off under the wing; then grooved under the wing as at *B*; next bored and grooved inside the hole at *C* and finally the bead is milled at *D*.

The first four operations are done in rotation on machines like the one shown in Fig. 20, which were built expressly for the purpose and are enormously powerful, rigid and heavy machines.

The spindles of the machine are automatically raised or lowered for the indexing or feeding operation, by means of the levers and cams shown at the top of the machine. The table carrying the chucks is shown enlarged in Fig. 21. There are five of these chucks, the finished coupling being removed and another one placed in the front one by the

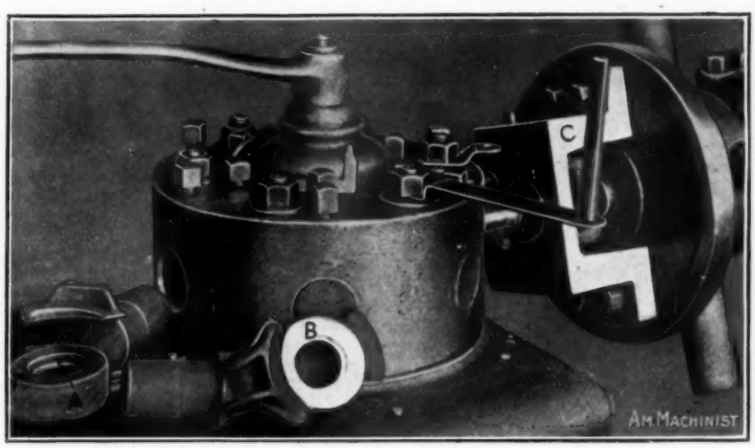


FIG. 22. THE GROOVING OPERATION

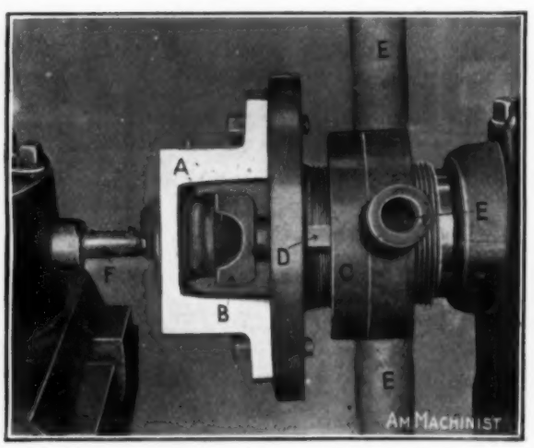


FIG. 23. DETAILS OF CHUCKING DEVICE

operator while the four spindles are at work on the others.

As the four spindles rise after finishing their cuts, the table is indexed by loosening the locking lever *A*, pulling out the lever *B* and turning it one notch, when the tools are lowered again and the next cuts taken.

FIG. 24. FIXTURE FOR MILLING OUTSIDE BEAD

TURNING THE INSIDE GROOVE

The groove *A* and the inside of the hole are turned in a lathe fitted as shown in Fig. 22, the surface *B* of the coupling being pressed outward from the back, against the inside surface of the fixture *C*, a better view of which is given in Fig. 23.

From this halftone it will be seen that the coupling is inserted from the inside of the bridge *A* which is cut away to make room for the wing and allow the flat surface of the coupling to rest against the inside as previously stated. The coupling is forced outward against the bridge by the forked piece *B* operated by the threaded collar *C* in contact with the pins *D* on the stem of the work, the pins working in slots in the spindle. The screw collar is turned when the spindle is at rest by means of the handles *E*. The holes are bored out by a tool in the turret and then are grooved with the tool shown at *F*.

MILLING THE BEAD

The head on the outside lip of the coupling is cut with a formed mill, while the coupling is held in the fixture shown in Fig. 24. In this fixture the coupling is placed on the block *A* and a lead block *B* is placed on top; then the handwheel *C* is run down, clamping the piece firmly in place; next the clutch for the worm *D* is thrown in and the work gear *E* revolves, carrying the lip under the cutter *F*, the bead being cut at one pass.

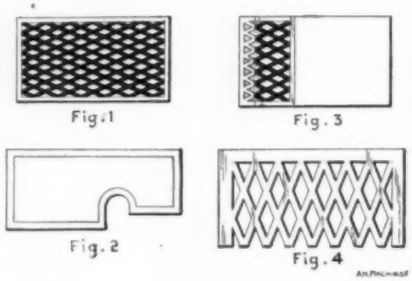
Jobbing Shop Pattern Making for Grids

BY W. POTTER

Among other jobs that come into the shop where I was employed, was one of a kind that was fairly frequent. This consisted of grids of different sizes and various designs, such for instance as the one shown in Fig. 1, one of the most common designs.

To make a casting for this looks simple and no doubt would be if all architects and engineers were of the same mind when designing them. It is only when the necessity arises to look into these seemingly small matters that the large variety of designs in actual use is appreciated.

Where a large number of grids of one size and design are required the initial



JOBBING SHOP PATTERN MAKING FOR GRIDS

cost of making a pattern to suit may not be a serious item, but when the same design has to be matched by the jobbing shop for a single casting it becomes a question of "making shift." It may be that an ordinary diamond grid of an irregular size or form is required. This should not prove a difficult job if there is a stock pattern somewhat near the same design.

If the outline of the casting is to be a plain rectangular or square, but less in size than the pattern, all that is required is a little "stopping off," a process practically every molder is familiar with, In this case he is supplied with two stopping-off strips made respectively to the correct length and breadth of grid, and to correspond with the width of the border around the outsides. If the grid is to be longer than the pattern, whether of regular shape or otherwise, the molder is usually supplied with a frame made to the size and form required.

Often it is necessary to have a portion of the grid cut away as shown in Fig. 2. This allows for pipes or other projections which may be in the way. Where this occurs the frame supplied to the molder is cut away to suit. After the stock pattern has been molded and drawn out of the sand, the frame, which is also made to correspond with the width of the border around the grid, is placed over the mold and bedded in. The sand around the outside of the frame being in shape, the latter is taken away, and where necessary cores are fixed in position to make up for the holes that were absent in the pattern.

When it comes to making a grid to match another one in which the holes are of a special design there are at least three courses open to the pattern maker. The first and most expensive is a complete new pattern. The second is to make a plain frame, the holes being formed with dry-sand cores fixed in position after the frame has been molded. The corebox is usually prepared so that about four cores can be made at the same time.

The third and perhaps the most satisfactory way is similar to the second method but instead of making dry-sand cores they are made in the mold in the following way, and as shown in Fig. 3:

A piece of wood the same thickness as the grid is procured. This should be wide enough to allow for cutting out two full and two half rows of grid holes as shown in Fig. 4.

This part pattern is laid in the mold, and thus green-sand cores are made and fixed in one operation. When the first half and full rows are rammed up, see Fig. 3, the pattern is withdrawn and turned around; the edge with the half holes should then fit up against the cores previously made, and the core-making process renewed.

This method has also been found most economical where iron patterns were required. In fact in many instances the making of a metal pattern by this method will be found better and cheaper than a wood pattern, even where only a few castings are required.

The Vickers System of Management

Editorial Correspondence

Engineers and machinery builders in America were considerably surprised a few months ago to learn that Secretary of the Navy Meyer had decided against all of the systems of shop management in use in this country and determined to install the Vickers system of management from the great British shipbuilding firm of Vickers, Ltd. The two following paragraphs, taken from the annual report of the secretary, show his determination and indicate the general results that he believes will be brought about by its adoption:

I found in England, at the works of Messrs. Vickers, Ltd., at Barrow-in-Furness, a most efficient and simple system of management. Briefly, it may be said that this establishment has an engineering department and a shipyard department, with an electrical division under the engineering department. They arrange in the larger jobs, for the orderly passage of the separate parts from one shop to another, instruct the workmen how to work most efficiently, and follow the separate operations by means of a corps of skilled progress men, until the assembly is completed. In a general way, the work is thoroughly systematized on common-sense principles, but no attempt is made to go into the forecasting of minute details. In consequence the extra cost of elaborate planning is avoided. The greatest percentage of increased efficiency seems to have been attained by broad effects in systematization and in securing the cheerful cooperation of the workmen toward best results through proper recognition of their initiative and more efficient effort.

I am entirely convinced, from the study of the different systems of so-called scientific management and close examination of the system employed at the Vickers plant in Barrow-in-Furness, that the main principles and practices of the best management are employed at the Vickers plant, with resulting increased efficiency and economy. The preliminary report received from two expert engineer officers, whom I sent over to study and bring back the details of the Vickers system confirms me in the impressions I have given above. The system and methods described appear to be suitable to our needs, and bear the birthmarks of common sense and simplicity of detail, reducing paper work to a minimum, starting work phenomenally quick after orders are received, following up work constantly and intelligently, thus securing results and correct costs.

The important features in the machine shops are: The use of the Halsey premium plan; time study and rate setting by a rate-fixing office; systematized tool designing in a special department; a carefully developed material and order system; a tracing or progress system and an independent inspection department.

Direct responsibility is placed upon the foremen.

The shipyard methods are less highly organized.

Naturally our readers are interested to know what this Vickers system of management consists of. We are pleased, therefore, to be able to supplement the broad statements from Secretary Meyer's reports with a few notes relative to the system in use at the Barrow works.

Divisions in the Barrow Works

The Barrow works is divided into three broad sections, namely, shop, engine and gun mounting. Of these the two latter constitute the engineering department.

About 10 years ago the premium system or premium bonus system was introduced from the Armstrong Ordnance Works at Elswick, where advance methods of rate setting had been established and maintained for many years. It is generally believed that the success of the Barrow works dates from the time when this premium system was put into use.

In this connection we refer our readers to a valuable paper on high-speed tools and machines written by H. J. Brackenbury, who controls the rate setting work at the Armstrong Ordnance Works. This paper was printed in extended abstract in the American Machinist, Vol. 33, page 290.

In general, the premium system is only used at Barrow in the machinist or metal-working trades, or as they are termed in England, "the engineering trades." This means that in the shipyard department only fitters and machinists are paid premiums. Men in the principal trades of platers, angle-iron smiths, riveters, calkers, ship drillers and blacksmiths work on piecework. Within the last year or two the pattern makers and machinists in the joiners' department have been put on premium. In the foundry the premium system has been put in force but at the expense of a severe strike and the employment of nonunion men on special terms.

Features of the Premium System

Broadly, the premium system is the Halsey premium plan, under which a bonus is paid to the workmen for one-half of the time saved. The basis time, as it is called, is arrived at for each job by estimating the time in which the job should be done and then adding 50 per cent.

The main feature of the system as operated is the time study conducted by a rate-fixing office employing rate fixers, or rate setters, assigned to the various trades and sections of the shop. Accumulated and systematized data for aiding and guiding the rate fixers in setting the time allowances are kept in the central rate-fixing office. The usefulness and capability of the chief rate fixer are, no doubt, most plainly shown in the discriminating use of this great mass of data.

In view of the importance of this work it is of interest to present particulars of the principles adopted in fixing rates for the more common machine-shop tools. This we are able to do by quoting from an article on "Estimating and Rate Fixing for Fitting and Machine Shops" which appeared in *The Engineer*, of London, in the issues of Sept. 25 and Oct. 2, 1908. Some slight changes have been made in terms to suit American shop practice.

Planers, Slotters and Similar Machines

Commencing with the above machines, which are all of the same principle of construction, we must, before being able to estimate work on them, know something about their principal characteristics: Greatest travel, cutting speed in feet per minute, number of tools, breadth of table, greatest height machine will take below cross-slide, number of feeds possible, etc. Now as it is not economical to machine work always with the same length of travel, we have a variable length of stroke; consequently, for a constant speed of the driving belt we have a variable number of strokes per minute for the machine. Therefore, the first thing to do is to find a factor for every machine of this type, that we may have a ready means of finding the number of strokes per minute for any length of travel that may be required.

No. of Machine	Type	Greatest Travel	Feeds per In.	Shortest Length of Stroke	Factor	Size of Table	No. of Tools	Greatest Height on Machine
12	Planer	15 ft.	Up to $\frac{3}{8}$"	2 ft.	122	16x8 ft.	2 top boxes 4 side boxes	12 ft.
13	Slotter	3 ft. 6 in.	Up to $\frac{1}{4}$"	9 in.	214	3 ft. dia.	1 tool	3 ft.
72	Shaper	4 ft.	Up to $\frac{1}{4}$"	1 ft	160	No table plate on floor	2 tools	
131	R. planer	12 ft.	Up to $\frac{1}{16}$"	3 ft.	134	12x3 ft.	1 tool	4 ft.

TABLE FOR PLANERS, ETC.

Note—Nos. 12 and 13 are very powerful machines.

Method of Finding Factor

Allow the machine to travel, say ten completed strokes, note the time taken, say 15 min. 40 sec., and the length of stroke, say 15 ft.

$$\text{Factor of machine} = \frac{\text{Length of stroke} \times \text{number of strokes}}{\text{Time taken}} = \frac{15 \text{ ft.} \times 12 \times 10}{15.66} = 114.$$

In other words, 114 = the number of inches the tool will machine per minute, taking the reversing stroke into account. Should the tool cut both forward and reverse, then the length of stroke in the above formula should be multiplied by 2. It follows from this that

$$\text{Number of strokes per minute} = \frac{\text{Factor of machine}}{\text{Length of travel of tool or table}}$$

That the length of travel exceeds the length of work to be machined must not be overlooked, especially as in a short job the extra travel may nearly equal the length of the work itself, and on some fast machines a stroke of about 2 ft. would be needed to machine a boss perhaps only 3 in. in diameter.

It will be necessary to find a factor for every machine of this type, which comprises planers, both horizontal and radial, slotters, shapers and combined planers and slotters.

ESTIMATE FOR A PLANER

Actual time = cutting time + 10 per cent. for putting on cuts and feeds + setting time + time for gaging.

The cutting time consists of both roughing and finishing times, but in either case the same formula is used, the difference being in the feeds and the number of cuts employed. The estimator's practical experience will tell him this, and will depend on the work itself.

$$\text{Cutting time in minutes} = \frac{(\text{Breadth of surface} + 1 \text{ in.}) \times \text{number of feeds} \times \text{number of cuts}}{\text{Number of strokes per minute}}$$

Slotters are estimated in a similar way, only the "breadth of the work" becomes the "distance round the work" in the estimate.

Shapers and radial planers are estimated in exactly the same manner.

CIRCULAR PLANERS, TURRET LATHES, ETC.

In dealing with machine tools having a circular motion, such as lathes, turret lathes, automatic machines, circular planers, borers, and large horizontal borers, it is first necessary to know what each machine is capable of doing. That is to say, the greatest possible number of revolutions, swinging radius, size of work the machine is capable of accommodating, feeds, etc.

ESTIMATE FOR THE ABOVE MACHINES

Actual time = cutting time for roughing work + cutting time for finishing work + time for putting on feeds and cuts + time for gaging + time for setting tools and work.

It is desirable that each of these times should be estimated on its own merits, except the time for putting on feeds and cuts. This time will vary between 15 per cent. and 30 per cent. of the cutting time. The less intricate the work the smaller the percentage added for feeds and cuts. In estimating the setting time, the number of bolts necessary to secure the work, weight of job, accuracy required, ease of manipulation, must all be taken into account.

$$\text{The cutting time in minutes} = \frac{\text{Length of travel} \times \text{number of cuts} \times \text{number of feeds}}{\text{Number of revolutions per minute}}$$

In all these machines, by "the travel" is meant the distance traversed by the tool, and is a little more than the length of the work, perhaps an inch or so.

DRILLING MACHINES

In estimating, the number of revolutions possible on the large machines should be ascertained and tabulated, with any other special information which might be necessary, such as size of table, length of radial arm, etc. The smaller machines, however, may be considered as running such a number of revolutions per minute as will give a cutting speed of, say 30 ft. per minute for mild steel. Then the number of revolutions of the drill per minute =

$$\frac{\text{Cutting speed per minute in inches}}{\text{Diameter of drill} \times 3.14}$$

Actual time in minutes = cutting time in minutes + extra per tool + extra per center + extra per shift + setting time.

$$\text{Cutting time} = \frac{\text{Depth of hole} \times 170 \text{ feeds per inch of depth} \times \text{number of drills necessary to get correct diameter}}{\text{Average number of revolutions per minute}}$$

GEAR CUTTERS

There are several kinds of gear cutters, which, though mostly of complicated design, are easily understood. The gear cutter which mills the teeth of racks, spur wheels and pinions must have the travel of the cutter per minute measured; this speed may vary. The safest plan, therefore, is to measure the travel of the table for the different speeds, and to tabulate it.

FORMULA FOR TOOTH-MILLING MACHINES

Actual time = cutting time + time for setting + half hour for setting and changing cutter.

$$\text{Cutting time in minutes} = \frac{\text{Travel of cutter} \times \text{number of cuts} \times \text{number of teeth to cut}}{\text{Travel of table per minute}}$$

The travel of the cutter should be the length of the tooth being milled plus the diameter of the cutter. To estimate the time of cutting teeth in beveled wheels on shapers, a factor must be calculated for each bevel gear cutter in the same way as with metal planers.

Laying out is, perhaps, the most difficult operation to estimate, it depending, first, on the rapidity with which the operative can read a drawing, and secondly, on his ability to transfer the sizes accurately onto the work. The only method that can be adopted is to estimate what one would like to do the work for, and put that quantity in for laying out in the estimate. A good many things, however, may be standardized, such as levers, brackets, bolt holes, rivet holes, teeth on wheels and racks and center lines on work for turning.

In considering the above it should be noted that the rate fixers are men selected from the company's workmen, and that they are stimulated in their work and their service made more permanent by the prospect of being promoted to positions of assistant foremen as opportunity offers.

ATTITUDE OF THE WORKMEN

One sentence in our quotation from the report of the Secretary of the Navy is to the effect that the cheerful coöperation of the workmen is secured through a proper recognition of their initiative and more efficient effort.

To a certain extent, this statement is supported by a number of quotations given below and taken from an article published in the *Barrow News* for Aug. 17, 1907 and entitled "Premium Bonus System at Barrow."

I have noticed time and time that my fellow workmen who are promoted from the ranks of the shop to be rate-fixing officers are men who have demonstrated beyond question their skill as masters of their particular branch of the engineering profession.

The rank and file of the Amalgamated Society of Engineers like the bonus system and would, I honestly believe, refuse to give it up, even if their society ordered them to do so. And again, under day work the employer is systematically robbed day in and day out. Under the bonus system the employer, to prevent this robbery, pays 12½ hours for a job estimated to take 10, but which he allows 15 for and which is done in 10. In other words, he pays wages 25 per cent. in excess of time wages to insure that men coming inside the factory gates do that which they profess to come for. And the proof that the employer was robbed in a deliberate and wholesale manner in the past, when day work was in operation, is found in the fact that even with the 25 per cent. average in addition to the wages, plus the cost of the rate fixers, he can now produce in both factories in greater quantities, because in less time than hitherto.

Another note is, however, indicated in a quotation which refers to the Carlisle agreement and states that the local chairman at Barrow writes:

Our shop stewards say there is nothing but the usual complaints. We know what that means. It means a daily intermittent strife between the operative and the rate fixer.

In reaching the Carlisle agreement Elswick led the way. The object of the conference was primarily to discuss the working of the bonus system at Elswick, but both parties represented recognized the desirability of viewing the whole question on a much broader basis and the reaching of a general understanding of the bonus or premium system.

ORGANIZATION OF THE BARROW WORKS

In regard to the organization of the Barrow works, the most advanced methods are found in the gun-mounting department. The engine department is a close follower, but the organization in the shipyard department does not vary materially from usual British shipyard practice, except perhaps in the use of the premium system for fitters.

In this discussion we refer to the executive organization as distinct from questions of mechanical equipment. In regard to the latter the company has taken a most advanced position and has invested large sums in machinery and tools.

The inspection department of the gun mounting division has a central headquarters with various branches. At the central headquarters all standard gages

are kept. Here also is a micrometer room suitably fitted up to inspect and care for the various instruments used in the inspection of finished work. Stores or supplies are conveniently situated in each department to suit the various requirements. Each has a direct connection to the main railway lines and a network of narrow-gage tracking within each bay of the works to facilitate the handling of material.

Drafting Room Organization

The drafting-room organization for ships consists of a senior draftsman, who is in charge of the designers for each ship, and under him a checker and a staff of draftsmen and apprentice draftsmen (who, by the way, spend part of their time in the mold loft laying out plating templates). Draftsmen are also assigned to the positions of outside drafting-room representatives, one for each ship under construction. Their duties are to handle all questions in regard to the interpretation and meaning of drawings, and act as agents through whom instructions can be given from the shipyard master to the foremen.

On the engineering side the organization conforms more closely to the usual drafting-room arrangement in which the work is split up to a considerable extent, and responsibility is divided. So far as possible there is continual contact and interchange of ideas between the various designers and head or general foremen. The apprentices employed in this office are selected from among the shop apprentices by means of suitable examinations.

The methods employed in making a set of plans is briefly this: The draftsmen work on a thin bond paper of such quality that they can trace upon it, if need be from other plans, or fit a proposed layout over other finished plans for the purpose of studying and checking. They do very little finishing on this drawing, only enough to enable the members of a tracing office to trace a finished drawing on cloth, and properly finish it.

There are two of these tracing offices, one on the ship or hull side and the other on the engineering side. The employees are young women who serve an apprenticeship of three years and in the course of that training become experts in making finished drawings from seemingly incomplete general layouts, or originals. After the tracing has been checked and all necessary reference to other drawings and plans properly verified, the original general layout is destroyed.

For purposes of filing, the tracings are folded and placed in strong envelopes. These envelopes are marked in accordance with a regular system of section symbols applying to each ship.

The ship drawings thus produced are not the detailed drawings that are finally used in the shop but are more in the nature of general arrangement and assemblies. The mechanical details are worked out or elaborated into detail drawings in a detail drawing room under the supervision of the general foreman of the fitting shop. Further, the general foremen of the other trades pick out the details with which they are concerned, and then forward their requisitions to the general store for material and supplies. On the other hand, the plating plans are practically completed with full details in the general drawing room.

The materials required by the fitting shop, and which must be purchased outside, are carefully listed on a bill-of-material form and entered in a book by the drafting room. Coöperating with the purchasing agent is a carefully trained technical man who has charge of these requisitions and assists in placing the orders. Similarly a special book of forms is used to list the ship's plates and bars, details of which are taken directly from the plans. This book is sent to the steel works as information from which they can prepare the plates and sections.

The plans of the engineering department are completed in all details in the drafting room and a bill of material required for each step is put on each plan in a suitable tabulated form. The parts appearing on each drawing are individually symbolied by numbers, 1, 2, 3 etc., in the case of castings, and by letters, A, B, C, et., for all other parts. Each plan is marked independently.

The contract number and the number of parts or sets required are, in the first instance, put on the tracing. For subsequent contracts the same drawings are issued with a linen ticket attached to each plan, giving the necessary particulars and calling attention to changes and differences.

All shop plans are printed on a black and white process linen-back paper, showing black lines on a white background, and for convenience in use are mounted on round sticks so that they can be rolled. As the designing proceeds shop plans are issued to the tool designing office, the rate-fixing office, general storeroom, pattern shop, machine shop, and fitting shop. Sketches for forging work are issued to the smith's shop as required.

The Tool-Designing Office

The tool-designing office carefully looks over its copy of these plans and determines what jigs, fixtures, and special tools are required. Furthermore it checks the ordinary tool equipment to make sure that everything needed of that nature is in stock, according to the standard list. A suitable form is used to list the jigs, fixtures and special tools that must be made, this being done with a sufficiently detailed description of their intended use to make this part clear to the foremen concerned. Linen prints of this list are attached to all of the shop plans at the earliest possible date. The reason for this is to notify the foremen as soon as possible of what is contemplated, so that they may satisfy themselves as to the adequateness of the contemplated tools.

All of these special tools are made in a separate tool-making department and are ordered by the tool-designing office. A copy of each tool drawing is furthermore sent to the rate-fixing office for reference.

Another duty of the tool-designing office is to pick off from each plan the bolts, studs, screws, pins and similar parts, and order them from the bolt-making department. In making the necessary sketches for this purpose rubber stamps are used to illustrate the various types, and dimensions only are filled in. The time saved by this course is readily appreciated.

Both studs and screws when made are inspected and checked by a shop inspector, and if correct, are sent to the storeroom, where they are kept in boxes or trays, labeled with the drawing number and identification letter, from which they were made. Thus they are held in readiness to be sent out.

After the shop and corresponding special tool plans are turned over to the rate-fixing office, certain of the time allowance estimates are prepared for the various operations. This is done in advance of the requirements of the shop, although the shop foremen determine upon the operation themselves, where they are not restricted by the jigs, fixtures and special tools that have been designed. Thus the greater part of the time allowances is not finally determined until the shop foremen have advised the rate fixers of their intention in regard to the operations by which the various pieces are to be produced.

It is not out of place to state here that the assistant foremen are paid a bonus in proportion to the earnings of their men. No bonus, however, is paid if less than an average premium of 25 per cent. is earned. The general foremen do not participate in this bonus payment.

Stockroom System

The general stores, or stockrooms, check off from their set of shop plans the information and data pertaining to requisitioning, checking receipts, and issuing materials and supplies. All castings and forgings are held in the storerooms until inspected and approved, if such approval is necessary, by the inspector of the contracting government.

When any material is ready to be issued, it is sent to the department concerned, together with a work card or ticket, stating the quantity delivered. A delivery book having detachable duplicate tickets is used for the double purpose of obtaining a signature acknowledging the receipt of the material, and the providing of a duplicate ticket to be left with the general foreman. These duplicate tickets later serve as a means of instruction

to the assistant foremen who are to oversee the work directly.

Delivery books similar to those used by the storerooms are brought into service when material is moved from one department to another. These tickets give the necessary instruction as to what further work is required. To facilitate reference, separate delivery books are used for each contract.

The general foreman of each department prepares a list of the parts and quantities with which he is concerned from his copy of the shop plans. These lists are made out in separate progress books, one for each contract. The general foreman is duly supplied by the management with particulars of inspection and delivery dates, and the various items in the progress books are marked accordingly.

The Tracing System

When material or work from other departments is not forthcoming at a proper time to allow these dates to be lived up to, reference is made to a central progress office, where the matter is taken up and urging and pressure brought to bear in the right quarter to hasten the work. Further, this office independently follows up the progress of all the large parts. Thus it corresponds with the tracing organizations which are commonly known in this country.

To still further follow up the work and settle and determine how best to make up for unavoidable delays that may occur, weekly conferences are held, presided over by the works manager, at which are present the general foremen, representatives of the drafting room, the chief of the progress office and the storekeeper. The various shop foremen are responsible for checking the work produced to see that it is in accordance with the drawing. They make use of shop inspectors for that purpose.

Further, there is an independent inspection department in charge of a chief inspector, who is the final referee on all questions of work as to whether or not it is in conformity with the drawings, or is in any way defective. His decision determines what work shall be thrown away, unless it is ordered to be destroyed on the authority of the shop foreman responsible. It is the duty of the chief inspector to submit all methods for the repair of defective work to the inspectors of the contracting department, and to keep a record of their sanction and orders.

The chief inspector, through his leading inspector, is responsible for submitting all work to government inspectors, and to have in readiness all gages, tools, etc., that may be necessary for the work of inspection. When the chief shop inspector is satisfied that everything is satisfactory, a note is sent to the government inspector, informing him of that fact.

A work clerk or foreman's clerk is assigned to each assistant foreman. It is his duty to issue the job cards to the men when giving out work, and upon him rests the responsibility for seeing that these cards are correctly filled out. In the case of premium work the card has an attached coupon, which on being issued is torn off and handed to the rate fixer. This man immediately sees that the proper time allowance is entered on the man's job card. Notes are made on the job card as the work proceeds, if any extra allowance is granted by the rate fixer on account of excess finish, hard material, breakdown of the machine or tools, and the like.

The time spent on each job is entered by the workmen themselves on the back of the job card, and at the end of the day these are placed in suitable receptacles, from which they are collected by a representative of the time-keeping office. On the following day the time-keeping office reissues these cards on all unfinished jobs.

When a job is completely finished the card is signed accordingly by the assistant foreman, and after passing through the time-keeping office goes to the central rate-fixing office, where it constitutes a permanent record of the labor done. If the basis time has been exceeded, an explanation is required from the foreman.

The time entries on the job cards are used in the time-keeping office for calculating the premium earned, for computing costs, and for checking the timekeeper who records from brass checks. The men check both coming in and going out. A check is always picked up as the man goes in, and then returned to the time-keeping office when he goes out.

The foremen register their time on a mechanical time recorder, and are required to be on the shop floor when the whistle blows to begin work.

A Universal Card Index

By Entropy

Every one of us has had his fling at indexing current engineering literature, and almost every one of us has dropped his pet scheme sooner or later, the majority sooner. The difficulty seems to lie in two directions: One that we begin to realize the enormity of the task of making anything like a complete index, and the other that our needs vary so much from time to time that what we selected a year ago no longer meets our needs. We get in contact with a line of work, we look in our card index for something in that line and we find it practically empty, and yet we have a decided feeling that only a few months ago we saw a good article on that very topic in some paper.

If we start out to make a comprehensive index, we find that the job totals up so big that we have to cut out all our work and part of our sleep to keep up with it. In spite of all this, we have to admit that the man with a command of what others have done is the man who can solve the new problems which arise, so we are dependent on current periodicals, for books are hopelessly far behind. What are we going to do to dispel this gloom?

A solution which occurs to me is to be found partly concealed and partly revealed on one of the back pages of the advertising section of the American Machinist. It consists in having every technical, engineering and shop paper print its table of contents with a brief, very brief, synopsis of each article in such form that it can easily be cut up and pasted on standard index cards; or, better yet, print its index on cards for sale.

If this scheme could be adopted by a sufficient number of similar journals, it would be possible for men to go along year after year practically ignoring all topics except those in which they felt an immediate interest, and subscribing for a supply of index cards for those topics from each journal they liked. Then, if for a time interest shifted, for example if a question of design came up in the office, it would be possible to send an order to so many journals as would be likely to have articles of that nature, for all cards published within the last five or ten years which came under the classification which would include that subject. All this could be done in exactly the same way that one can now buy all patent specifications which come under certain classifications.

This would put the burden of carrying card indexes upon the papers themselves, and would assure the purchaser that the indexing would be thorough. It would also mean that every paper could keep its contents alive much longer than is the case at present. It might be a source of profit or loss to the papers, according to the number of periodicals adopting the scheme, but if fully understood by engineers and readers in general, it would be a profitable matter both for them and the publishers.

I believe that a universal card index of all engineering and shop literature is a feasible thing; also, that it is practicable to devise a uniform classification, making it possible to get the titles of all valuable articles on any given subject by return mail. Workmen, proprietors and engineers are too busy to make a classification themselves, and to cull the topics which perchance they may need 10 years from now. It is clearly the business of the papers themselves to do it, but first there must be a classification, then a concerted effort to place the contents of the papers before the public, not merely on the date of publication and at the end of the year, but all the time.

Fixtures and Gages for Rock Drills

By Fred H. Colvin

Testing work is often a difficult matter, especially in interior chambers and openings such as occur in rock-drill work. The gaging methods shown secure accurate results and materially assist in inspection.

The drilling fixtures are particularly good examples of handling work with holes at various angles and in different planes.

Compressed air is such a thin substance and gets through such small openings that the mechanisms for holding it require a very high degree of accuracy in the fitting of all moving parts. For this reason rock drills, pneumatic hammers and the like, have to be made very accurately and this requires delicate and interesting gages and measuring devices. Some of these, used by the Denver Rock Drill & Machinery Works, Denver, Colo., are shown.

The head of a drill and the plug valve which fits into it, are shown in Fig. 1. The holes *A* and *B* must register with the holes in the plug when that is put in place, which means that the length of the taper must be right, as the top also forms a seat.

The gages for both the plug and taper hole are shown in Fig. 2; the plug in front gages the hole and the block *A*, with its taper hole for the plug, the feeler *B* and the pointer *P* show when the plug is the right length. The opening at *C* allows the fit of the plug in the taper to be examined easily.

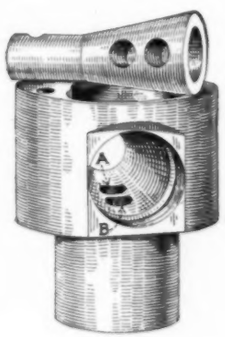


FIG. 1. VALVE BODY AND KEY PLUG

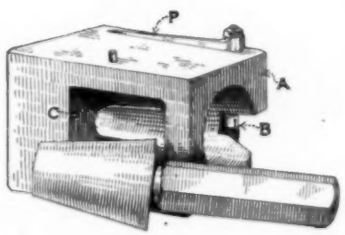


FIG. 2. GAGES FOR KEY AND BODY

How the plug and block gages are used to test each other is seen in Fig. 3. The deviation of the pointer *P* from its proper position on the block, as indicated by the zero mark, shows instantly that either the plug or the block was wrong. The operation of the block gage can be seen from Fig. 4 where a plug *X* is in position to be tested.

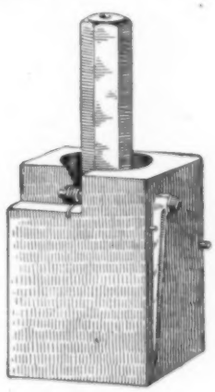


FIG. 3. THE GAGES TEST EACH OTHER

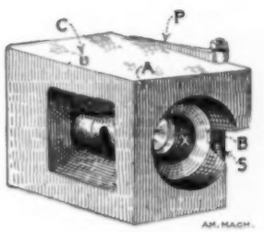


FIG. 4. TESTING A KEY

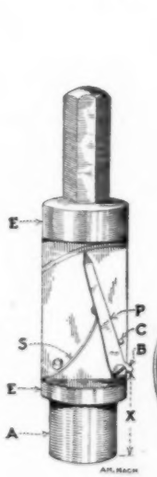


FIG. 5

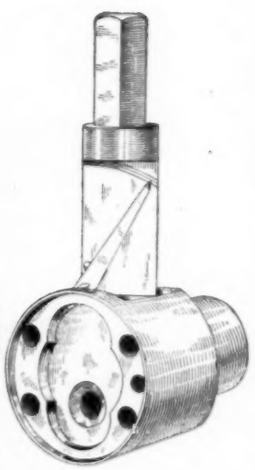


FIG. 6

GAGE FOR TESTING DEPTH OF SHOULDER

The indicating or feeling finger *B* is connected to the pointer *P* through the shaft running up through the block, both moving together. To insert a plug, the pointer *P* is swung to the left against the pin *C*. This moves the feeler *B* out of the way so that the plug can be slipped into place. Then the spring *S* is allowed to press the feeler *B* against the end of the plug and the position of the pointer *P* noted.

A DEPTH GAGE

A type of depth gage for testing the distance between internal shoulders, which are not easily accessible, is shown in Fig. 5, while Fig. 6 shows the way it is used.

The gage consists of a round body cut away in the center to provide a flat surface for the pointer *P* and also to protect it by the flanges *E E*. The end *A* fits into the hole to be measured; the distance between the end of this and the feeler *B*, shown as *X* in the illustration, is the distance to be measured. The pointer *P* is stopped by the pin *C* and controlled by the spring *S*, the position of the point on the arc indicating whether it is correct or not.

As can be seen from Fig. 6, this measures the depth of the straight part of the hole which carries the plug, in Fig. 1. The pointer or lever multiplies 10 times and the limit marks are 0.03 in each side of the center, making a limit of 0.003 in. plus or minus.

The relation between the flat surface and the shank or smaller diameter, is shown by the gage in Figs. 7 and 8. The surface *D* rests on the flat while the feeler *C* touches the round shank. If the relation is correct, the pointer *P* will be forced across the handle *B*, to the work shown. The pins *G G* straddle the shank and keep the gage in correct position on the piece to be measured.

LOCATING AN INSIDE HOLE

In the piece shown in Fig. 9 the hole *X* must be tested for its relation to the shoulder which cuts into it or is cut into by it. This hole is at an angle, being drilled on the angular drilling fixture shown in Fig. 17.

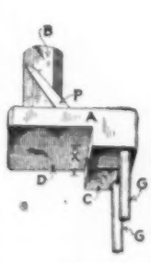


FIG. 7.

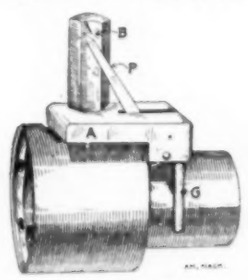


FIG. 8

GAGE FOR TESTING FLAT SURFACES

The testing is done with the gage shown in Fig. 10 by means of the pin *P* which passes through the plug at the cor-

rect angle until it reaches into the hole to be tested. After the pin is in place the bushing *A*, which surrounds the pin, is pushed down until it bears, and the reading taken from the inclined surface of the bushing. This allows very close reading and rapid inspection. Fig. 11 shows the gage in position with the bushing pushed down ready for the test.

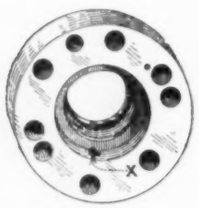


FIG. 9. A PIECE TO BE TESTED

FIG. 10. GAGE FOR TESTING ANGULAR HOLE

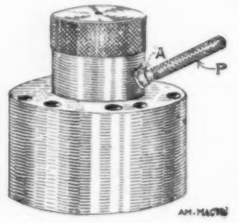


FIG. 11. THE GAGE IN PLACE

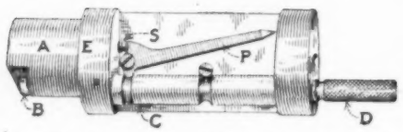


FIG. 12. ANOTHER GAGE FOR TESTING SHOULDERS

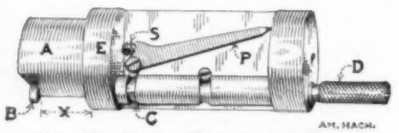


FIG. 13. SAME GAGE WITH FILLER TURNED OUT

MEASURING OUTSIDE OF SHOULDERS

An indicator to show the distance between the outside, or opposite side, of two shoulders is shown in Fig. 12. This is somewhat similar to the gage in Fig. 5, but serves a different purpose.

The part *A* slips through the hole until the shoulder *E* seats itself. Then the knurled handle *D* is turned to throw the feeler *B* out as in Fig. 13. The spring *S* and the groove at *C* control the position of the pointer *P* which indicates the distance between the shoulders being measured. The wider groove in the center allows the measuring rod ample end movement for the work to be measured.

The limit marks in this case are 0.025 in. each side of the center, making the limit 0.0025 in. plus or minus as the lever arms are also 10 to 1 in this case.

A modification of the type of gage in Fig. 11 is shown in Fig. 14. This is for gaging a shoulder with relation to a taper hole, there being a double taper in this case. The taper makes it necessary to reduce the limits to 0.002 in., using the same levers as before.

Still another modification of this type of gage is shown in Fig. 15 where it is used to gage the position of the valve seat shown in place in the gage. The same proportion of levers is used and the limit is even closer in this case, being 0.0015 in. plus or minus.

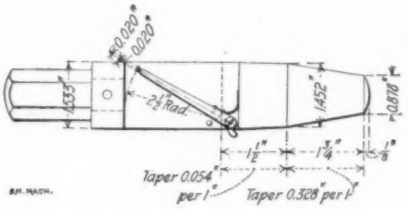


FIG. 14. GAGE FOR SHOULDERS AND A TAPER FIT

The air holes or ports which admit air to the bottom end of the cylinder require very accurate drilling as the thickness of metal between the holes drilled and the cylinder wall is often less than $\frac{1}{16}$ inch. This allows very little for the running of a drill and is one of the cases where a sensitive drill has always proved the most satisfactory.

The holes are started with the aid of a drilling fixture as can be seen in Fig. 16 and the hole drilled to a depth of about one inch. This locates the port very accurately and the remainder of the drilling is done by hand feeding. The fixture shown has a number of good points. The cylinder is secured on the blocks *AA* and held in position by the clamp *L* and the thumb-nut *T*.

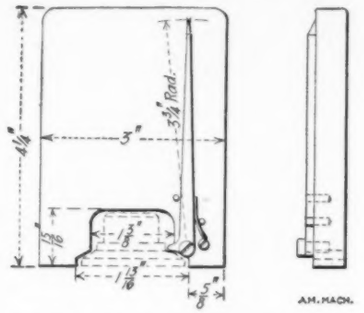


FIG. 15. GAGE FOR VALVE SEATS

This fixture locates different holes at each end of the cylinder and is what many term a roll-over jig, as can be seen by the feet on each end. In order to facilitate this turning over from one end to the other, and also to save both the fixture and the driller table from injury, a rocker has been placed on each side of the bottom of the fixture at *R* which makes it very easy to turn the fixture over even on the large sizes, which weigh many pounds.

MORE DRILLER JIGS

Two other drilling fixtures are shown in Fig. 17. These give a good idea of the large amount of drilling necessary on work of this kind. This fixture at the right is also a double ended affair but does not seem to be one to which a rocker can be very advantageously applied. Nor is there the same necessity as in the other case as it is much lighter and more easily handled.

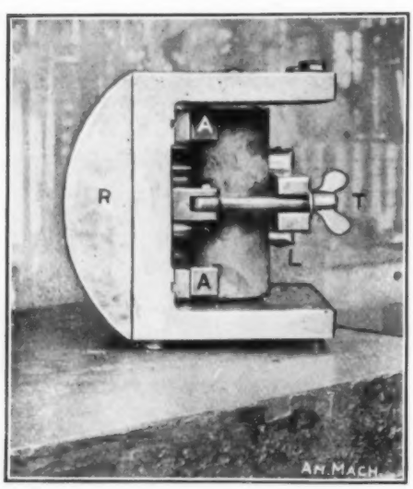


FIG. 16. A DRILL JIG ON ROCKERS

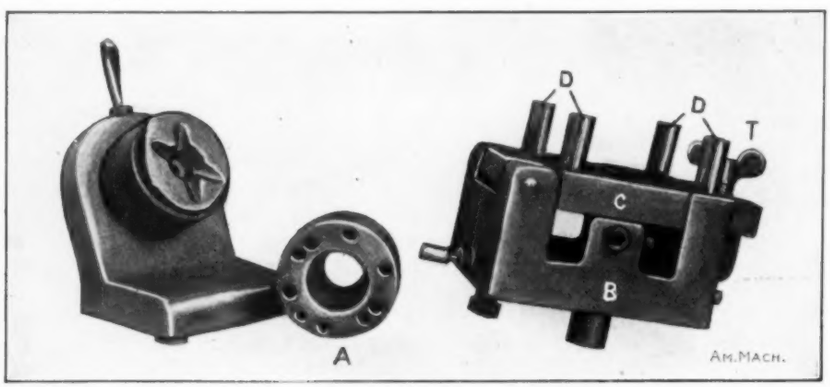


FIG. 17. DRILL JIG FOR ANGULAR HOLES

The ring to be drilled is held in place by the hinged plate which is on top in the view shown and which carries nine hardened bushings in addition to the four feet which project above the thumb-screw in order to hold the jig squarely when in the reverse position.

the piece between the two jigs. These two fixtures handle all the holes in the piece shown.

A Drilling Fixture with Many Uses

A drilling fixture which performs a variety of operations on the flanged sleeves all the various operations on the sleeve shown, except that of sawing the slot, which is done in the miller. It also gives a good idea of some of the problems which are presented in this kind of work, and indicates that mechanical ingenuity is pretty well distributed throughout various

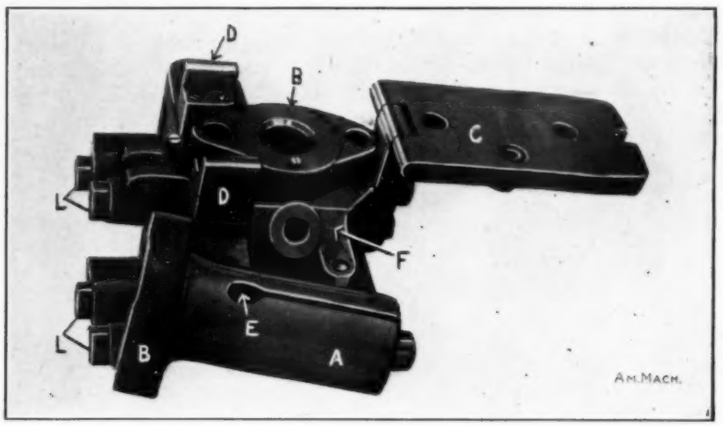


Fig. 18. Jig with Top Plate Open

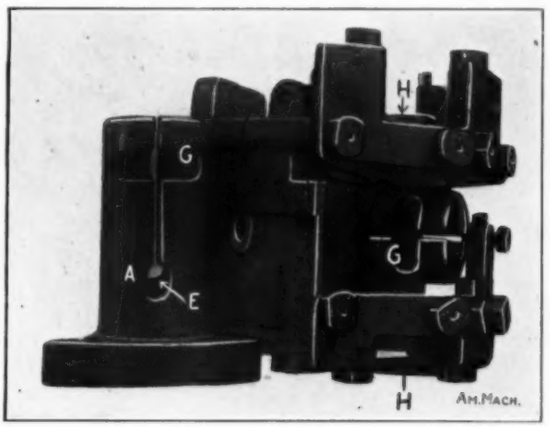


Fig. 19. Drilling the Crosshole

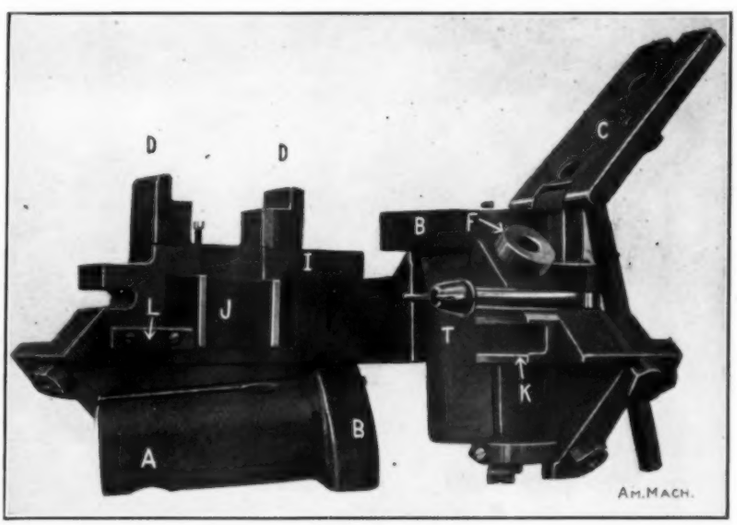


Fig. 20. The Jig Opened up

It will be noted that in the position shown the jig is pitched to the right as it bears on a pair of feet, one being shown at *A*. This allows the holes on one side of the ring to be drilled at the proper angle, the fixture resting on the sheet *A* and the corner *B* for the clipping. The other holes require the jig to be pitched in the other direction so that it rests on the feet *A* and the screw *C*. The same jig also has bushings for holes on the guide and, by turning it over on the four feet, holes are drilled from the other end in their proper places.

After all these holes have been drilled the piece goes on the angular jig shown at the left which has a piece already in place. The angle of the piece supporting the bushings, together with the portions cut away allow the passage of the drill and drill the holes from the interior of the chamber, which can just be seen in shown in the foreground in each case is seen in Figs. 18, 19 and 20. Beginning with Fig. 18, we see the piece in place after the three holes in the flange have been drilled. The top plate *C*, carrying the three drill bushings, has been thrown back, having been released by the latch. It is interesting to note that the plate has hard steel pieces inserted at each edge, which fit in and bear on the hardened pieces *D* D_1. These insure the exact location of the bushing plate, and allow considerable use with little wear, providing adjustment when it becomes necessary.

In Fig. 19, the sleeve has been turned into another position, so as to show the cross hole which cuts into the sleeve bore, and it also shows the fixture in position for drilling this opening at the end of the sleeve. This makes a very complete drilling fixture, as it handles parts of the country, and that no special locality or shop has any mortgage on mechanical ideas.

Going to Fig. 20, we see the fixture open still more to release the flanged sleeve, the whole clamping arm *I* is swung out of the way, showing how the V-shaped jaws center and hold the sleeve; giving a different view of the hardened guides *D D*, and also showing the locating piece *L* which fits into the plate *K*, both of these being hardened to prevent undue wear. The arm is held in place by the thumb-nut *T* on the end of the swinging locking bolt.

This view also shows the bushing *F* for drilling the angular hole which forms the end of the slot, feet being provided on the opposite side of the fixture so that the work may be accurately held at right angles for drilling this angular hole.

We are indebted to both the manager and the superintendent of the Denver Rock Drill & Engineering Co. for their coöperation in securing these illustrations, and the information regarding the work they are doing.

The cost of materials used in the industries of the United States was $12,141,291,000 in 1909, as against $8,500,208,000 in 1904, an increase of $3,641,083,000, or 43 per cent. The average cost of materials per establishment was approximately $45,000 in 1909 and $39,000 in 1904. In addition to the component materials which enter into the products of the establishment for the census year there are included fuel, rent of power and heat, and mill supplies. The cost of materials, however, does not include unused materials and supplies bought either for speculation or for use during a subsequent period.

Milling a Universal Joint Shaft

By A. J. Baker

The following description of the methods employed by The Cincinnati Milling Machine Co. in producing the universal joint shafts used on their machines, shows a rather unusual job, and presents some novel features, both in the use of the machine.

The shaft involved in the following operations is used in driving the feed mechanism on the machines manufactured by the Cincinnati Milling Machine Co. and is shown in detail in Fig. 1. It is made of steel, being machined entirely from bar stock by various lathe, grinder, miller and drill-press operations. These operations follow each other in the sequence given and are so arranged that the shaft when received by the milling department, is bored, reamed, the head formed to the outline *AB* on Fig. 1, and the shank ground.

There are three milling operations: First, form mill the flats as outlined at *DC*, Fig. 1, then clearance mill for the ball outline at *EF*, and finally mill the flats for the ball. This last operation is the only one in which accuracy is required, the working limits being 0.0007 in. for widths between flats to 0.003 in. out of center with axis of rotation of stock.

The first of these operations is represented in Fig. 2. It shows a No. 3 "Cincinnati" vertical miller fitted with a 20-in. circular milling attachment, to the table of which is bolted the holding fixture. This latter consists of two clamping blocks bored out to the size of the finished shank and located in the central T-slot of the table. The head of the work projects beyond these clamps and is located endwise by the removable stop *A*, which insures a sufficiency of metal being left for the forming of the semicircular end of the shaft.

The cutter, a special end mill of the helical type, detailed in Fig. 3, is carried in the taper hole in the spindle and

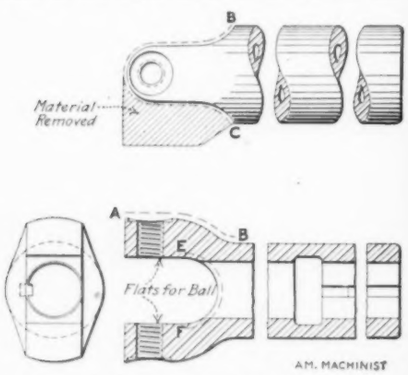


FIG. 1. SHAFT FOR DRIVING FEED MECHANISM

supported at its lower end by a bracket clamped to the knee bearing of the column. A hardened bush, driven by the pilot on the end of the cutter, rotates in the bracket, and is so made that chips cannot enter between the bearing surfaces and so cause wear and chatter.

Special stops are provided for both saddle and table movements. That for the saddle is merely to indicate to the operator when the cutter is fed in to approximately the right depth. The stop on the right side of the table is the standard hand stop with which the machine is equipped. The one on the left is special and can be rotated, presenting to the saddle against which it acts two pins of such length that the difference in table travel resulting from their use, equals the distance from the center of the semicircle forming the end of the piece, to the center of the cutter when at the end of its stroke. This is the dimension *GH* in Fig. 1.

The method of operation is as follows: With the saddle away from the cutter and toward the operator the work is inserted and clamped, using the removable end stop placed in the central T-slot at right angles with the slot immediately under the work, which latter slot is at this stage, parallel with the edge of the table.

The table is then brought by the quick return handle to the left until the hand stop strikes the saddle. The crossfeed is then engaged and the cutter feeds into the work until the stop on the saddle is close to the front of the knee. The operator then disengages the crossfeed and moves the saddle over by hand the remaining 20 or 30 thousandths until the crossfeed dial indicates zero.

The longitudinal feed is then engaged and the table feeds toward the right until the longer of the two stop pins on the rotary stop, carried on the left side of the table, approaches the saddle. The

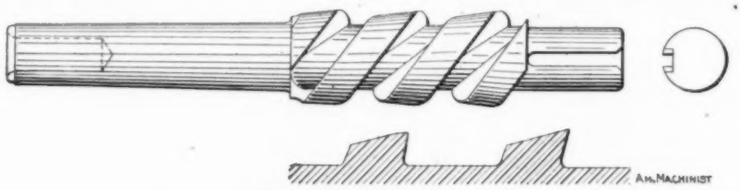


FIG. 3. THE CUTTER

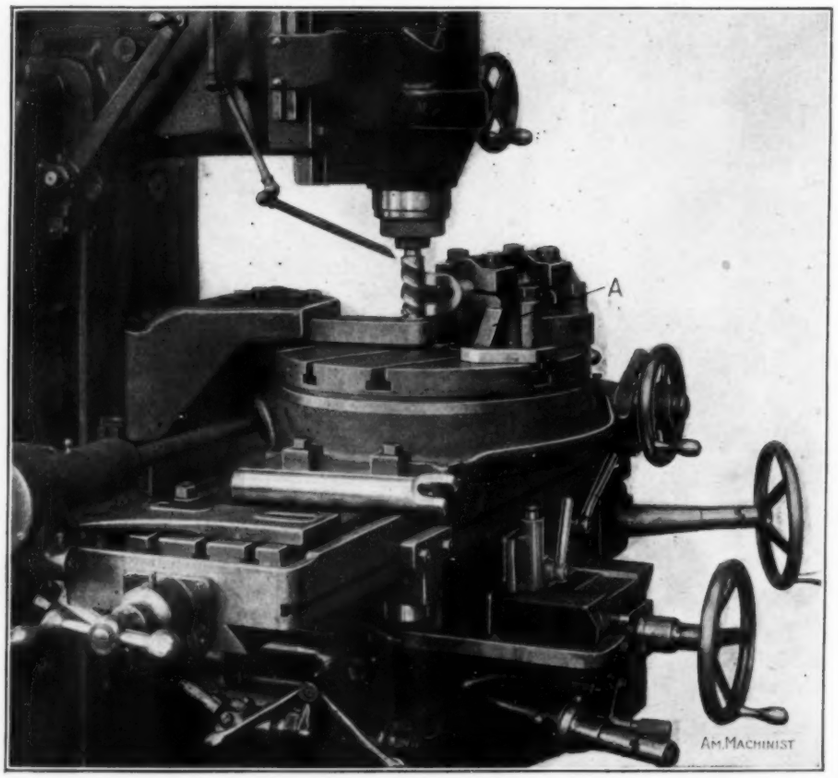


FIG. 2. FORM MILLING FLATS

feed is disengaged and the table brought up to the stop by hand. The circular table is then brought into action and is rotated, using the power feed, through 180 deg. At this point the shorter stop pin on the rotating stop is swung into line and the table feed is continued from left to right until it, in its turn, approaches the saddle. The final junction is made by hand, the saddle withdrawn and the operation completed.

A shaft can be machined in this manner in seven minutes and lots of 100 are run through without sharpening the cutter. The speeds and feeds are 94 r.p.m. and 2¼ in. per minute respectively.

The second operation is shown in Fig. 4, machining the semicircular clearance slot for the ball. The same type of cutter is employed as for the former operation, but minus the support, which in this case is unnecessary.

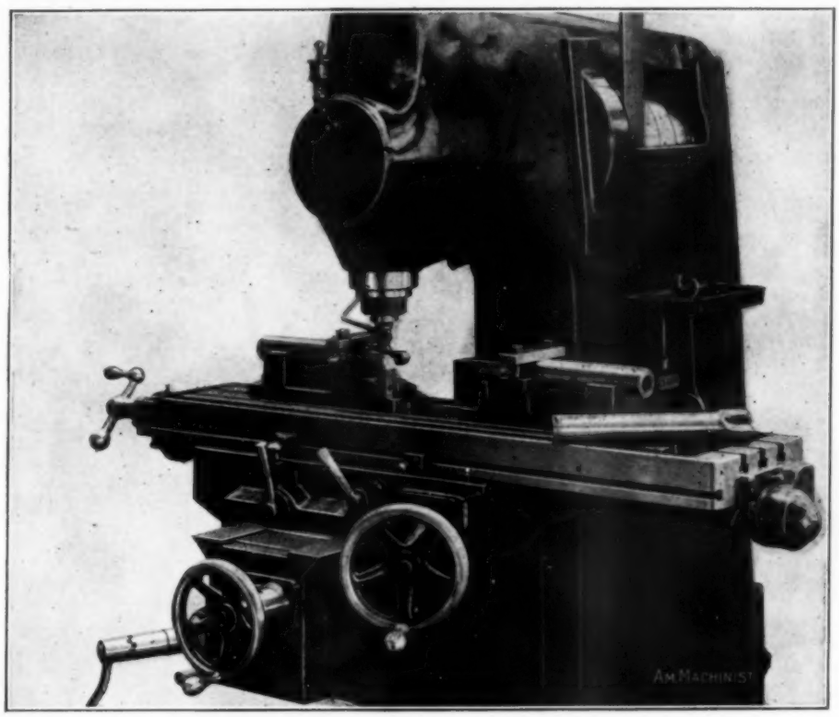


FIG. 4. CLEARANCE MILLING FOR THE BALL

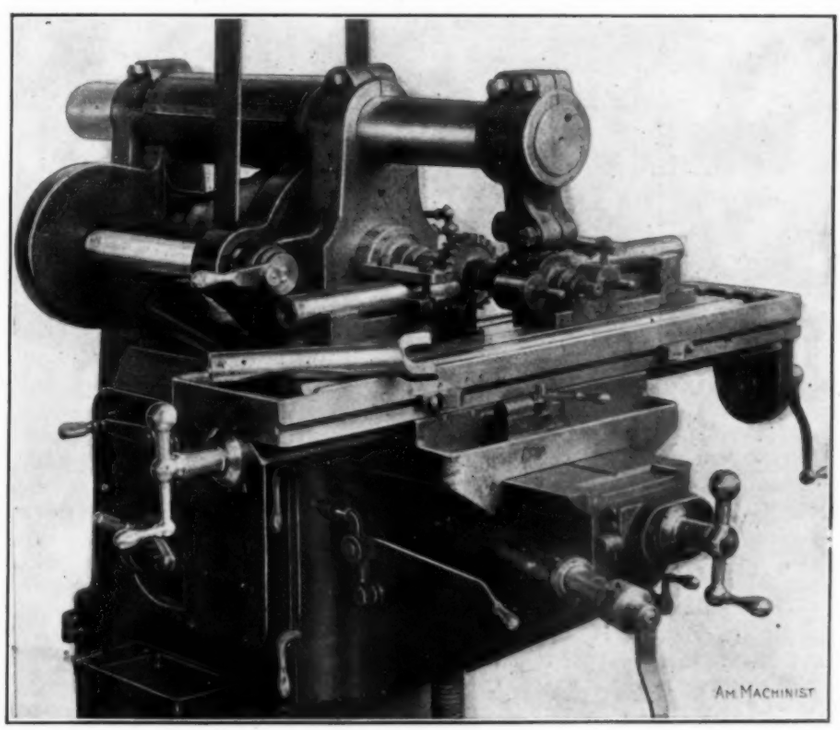


FIG. 5. FINISHING THE FLATS FOR THE BALL

Two fixtures are used, so that while the operator is loading or removing the work from one, cutting takes place in the work held in the other. The fixtures are of a simple type, the work being clamped in semicircular bearings and lined up by a wedge which brings the surfaces milled square with those produced by the previous operation.

The depth of cut is determined by the trip dogs which throw out the feed at the proper point. The cutter rotates at a speed of 154 r.p.m. with a table feed of 0.016 in. per revolution. The time for the operation is one minute.

The third operation is that of finishing the flats for the ball and is shown in Fig. 5. The machine carries a pair of interlocked milling cutters $\frac{3}{16}$ in. wide and 5 in. in diameter rotating at a speed of 67 r.p.m. The same fixtures as for the second operation are employed, so that the machine is cutting practically continuously. The pieces are all tested as they come from the machine with a special gage, which determines both the size of the slot and its central location with regard to the shank.

Using a feed of 0.020 in. per revolution, the pieces are turned out in one minute each. It will be seen that the total time for the milling operations on the piece specified amounts to nine minutes each, which, in view of the tolerably heavy cutting in the first operation and the accuracy required in the last, cannot be regarded as excessive. Attention is also directed to the very simple tool equipment required to produce this result.

Wasted Opportunity

It is probable that in no other portion of the world are coal, iron ore, and limestones so plentiful and so widely distributed as they are in Siberia, and in no other portion of the world has their development been so much neglected. It was supposed that the opening of the Siberian Railway would promote enterprise but it seems to have had no effect. The railway people have difficulty in procuring coal sufficient for the use of their locomotives at a high price and wood is almost universally used for domestic purposes.—*Railway and Locomotive Engineering.*

Prior to the introduction of the concrete tile and radial brick for chimney construction, the better grade of steel stack maintained an extensive use in both factory and power plant practice, and notwithstanding the close competition of the concrete and masonry chimney, the steel stack still retains a place of prominence with regard to special grades of work.

Making Worm Gears in England

By I. W. Chubb

The success of the worm gear on motor cars in England has been due largely to the care taken in manufacture. The methods used by E. G. Wrigley & Co., Ltd., Birmingham, specialists in this line. These include grinding operations.

The use of worm gearing on the back axles of motor cars has extended markedly in Great Britain, and within a quite recent period several firms on the Continent of Europe have taken up the practice, or, as shown by trial worm-gear sets ordered of British firms, are at least experimenting.

Of course, in Great Britain, more than one firm has a fairly lengthy experience already. The commercial cars made by the Dennis firm, at Guilford, Surrey, and the pleasure cars built by the Lanchester Motor Co., Birmingham, may be regarded as the pioneers. For a long time they were practically the only firms using a worm drive in this way. Success was met, owing largely to the care taken in manufacture, and during the past four or five years other British firms have adopted the worm drive with an advantage which, if perhaps varying, is, on the whole, quite pronounced.

Last year, for instance, only one firm reverted to the bevel-gear drive. At first the worms were of ordinary case-hardened steel, not ground, and though phosphor-bronze wheels were used, the quality of the metal was not always suitable. Among the gear firms who have specialized in this line, E. G. Wrigley & Co., Ltd., Birmingham, are certainly pronounced. They realized that a worm gear which had to transmit relatively high power with high-speed range, and with centers between worm and wheel of not more than six or seven inches, is a different problem from the ordinary engineering job where spaces are not so circumscribed, and where, therefore, ordinary margins of safety can easily be allowed.

The gear they produce, it is claimed, is practically equal in efficiency to the bevel gear at normal speed, will last just as long and is silent. The wheels are of hard close-grained phosphor-bronze, and the worms are of nickel steel or mild steel, case hardened, and ground all over on the tooth so as to be true to pitch and shape.

Instead of 14½ deg., the pressure angle may be 20 or even 25 deg., giving a tooth with a very strong root. The wheels are hobbed, a taper hob being employed, as shown in Fig. 1, while Figs. 2 and 3 illustrate the process of milling the thread on the worm. Here allowance is made for the subsequent grinding operation, care being taken, of course, that the amount left is not excessive, so that the grinding operation does not proceed below the depth of case hardening.

The method of grinding is illustrated in Figs. 4 and 5, the final process being to buff the teeth so as to remove anything approaching roughness, which would cut the teeth of the wheel. An attachment used for worm grinding and applicable to any of the grinders manufactured by the Churchill Machine Tool Co., Lt., Manchester, is illustrated in Figs. 6 and 7. The grinding

FIG. 1. HOBBING THE WORM GEAR

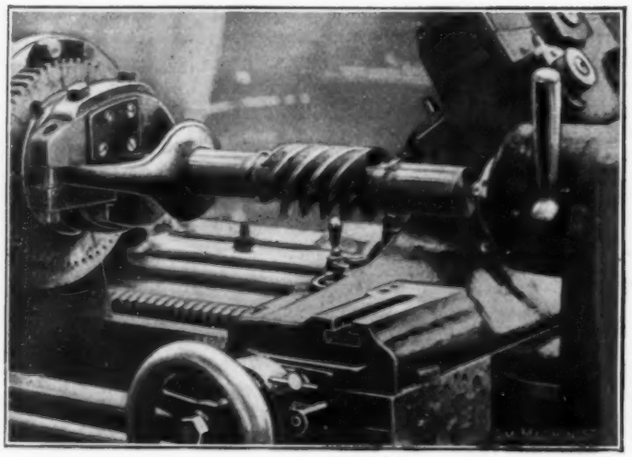


FIG. 2. THE WORM

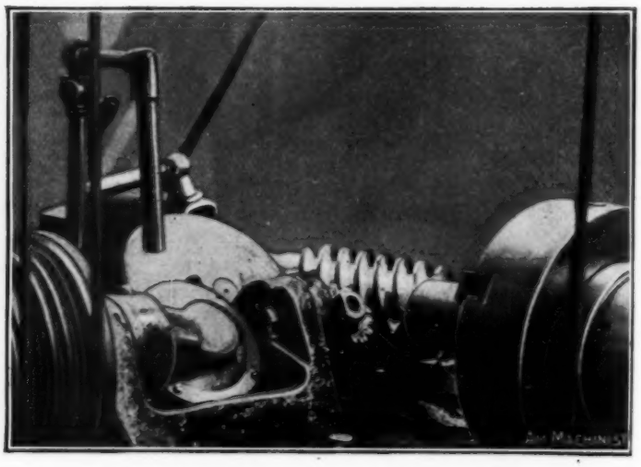


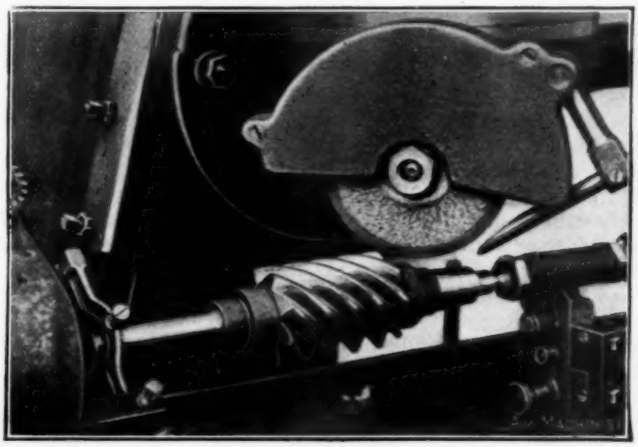
FIG. 3. MILLING THE THREAD ON THE WORM

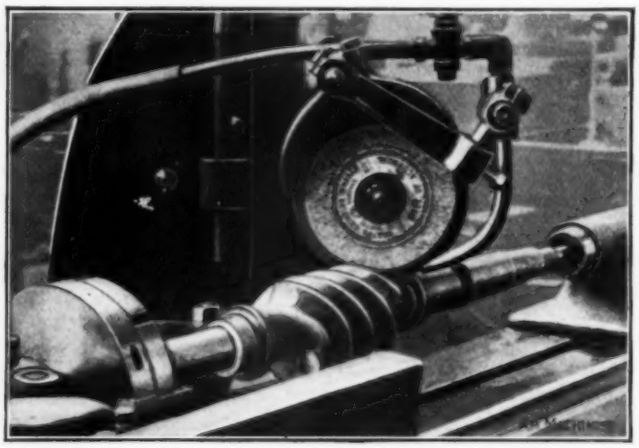
spindle swivels in all directions. Standard dished wheels are employed and a diamond insures that a constant angle is maintained on the wheel, irrespective of the angle of spiral. For driving the worm being ground, a rack is mounted on a frame, attached to the bed of the machine. This rack is of ten diametral pitch, and is cut from a precision screw based on the ratio of 1 D. P. equals 3.1416 in.

Change gears give the necessary ratio for lead of worm, the wheels used being interchangeable with those on the Brown

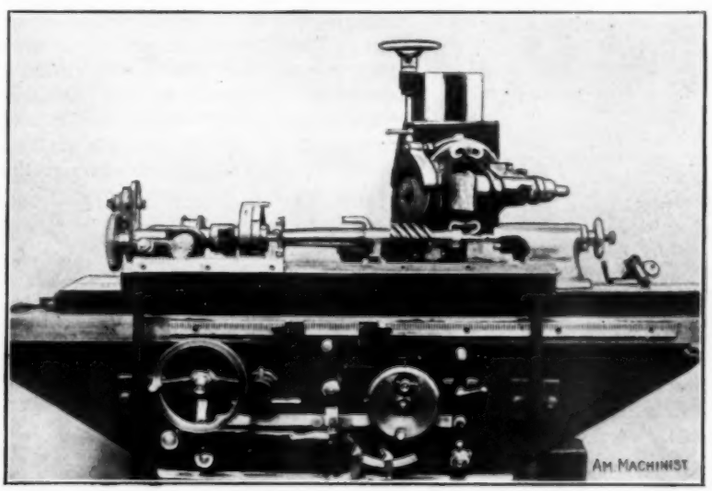
& Sharpe universal miller. The number of starts in the worm is governed by an index plate on the work-head spindle. The tailstock has spring tension to allow for expansion and all spindles are hardened and ground.

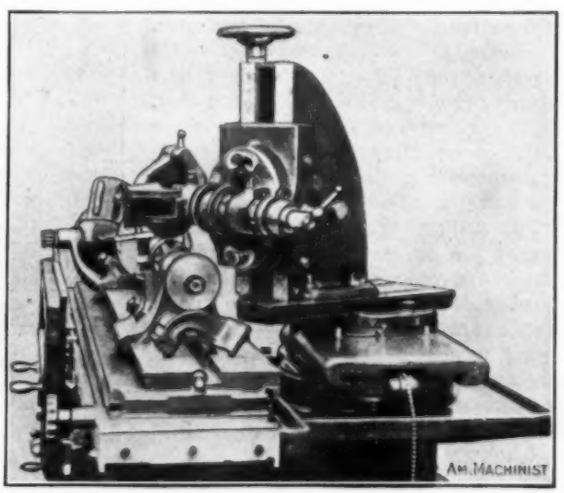
The table is worked by hand motion. The whole device can be removed and the machine converted to an ordinary grinder in less than an hour. The time taken to grind a seven-start worm for motor-car drive was 70 min.; this included turning round to deal with both sides of the thread. The worm was about 3½ in. in diameter, and the spiral angle 38 to 49 degrees.





FIGS. 4 AND 5. GRINDING THE WORM GEARS





FIGS. 6 AND 7. TWO VIEWS OF THE ATTACHMENT USED FOR WORM GRINDING

Saving Time and Taps

An example of the little economies which can be practiced in almost any shop, whether equipped with a complete system of management or not, is shown by the following instance: Some cold-rolled steel collars were to be tapped with a ¼-in. tap, having 24 threads per inch, of the United States form. As all that was necessary was to have the threads hold the setscrew against any strain that the setscrew itself could stand, it was soon found that it was unnecessary to have anywhere near a full thread.

A very good rule for such cases is to use a tap drill the same as the outside tap diameter, less ¼ the double depth of the thread. In this case the hole would have been 0.209 in. in diameter, but with a hole of this size the taps broke repeatedly and the hole was enlarged to 0.213 in. in diameter. Even with this enlarged diameter the taps continued breaking.

The hole was then enlarged to 0.219 in. in diameter and the tap worked very satisfactorily. Although this was not nearly a full thread, any setscrew which was tried in it would twist the head off before the thread would split. The hole was $\frac{5}{16}$ in. deep, and it was finally decided to use a $\frac{7}{32}$-in. drill, which is practically 0.219 in. in diameter, and this gave excellent results.

The little experimenting along this line established a standard practice in this shop, which has resulted in considerable saving, and can be duplicated in almost every shop having work of this kind.

Several classes of vanadium steels are made and in each class there is a variation in the carbon content. Ordinary carbon steels that are treated with vanadium can be obtained with nearly any carbon percentage that is desired. Vanadium steel can also be obtained in combination with nickel and called nickel-vanadium steel; or it may be obtained in combination with chromium and called chrome-vanadium steels. This last is by far the best steel. Nickel-vanadium steels are now seldom used in automobile construction as they are about as expensive as the chrome-vanadium steels and nowhere near as good results can be obtained with them. The carbon-vanadium steels have been used to a considerable extent for the less important parts of a car as better results are obtained than with the ordinary carbon steels and their cost is not as high as other alloys.—*Automobile.*

Grinding Large Iron Rolls

By F. B. Jacobs

On the subject of grinding the chilled-iron rolls used in flour mills, different authorities hold widely different opinions regarding the manner in which the roll should be held in the grinder. Notwithstanding the fact that some manufacturers of large cylindrical grinders claim that it is impossible to grind a true roll in any other way than by locating from the centers fully 95 per cent. of the rolls ground at the present time are ground by locating them from the journals or necks.

The flour-mill rolls in common use are from 12 to 36 in. long and from 6 to 12 in. in diameter, and are made of cast iron with the body chilled to a depth of from one-half to two inches. As these rolls are used in every flour mill in the country, the grinding of flour-mill rolls is in itself quite an industry and many thousand grinding wheels are made annually exclusively for this purpose.

Grinder of the Popular Type

The illustration shows the type of grinder generally used for this purpose. The machine is set on a cement foundation to reduce vibration to a minimum. The carriage carrying the wheel heads travels directly on substantial ways, thus insuring rigidity and reducing the chatter. Two grinding heads are used; these travel on separate crossways. The grinding wheels and the driving pulleys are between the spindle boxes, thus aiding in preventing chattering under heavy cuts. The spindle boxes are made of phosphor-bronze, and in some cases of a good grade of babbitt metal. The spindle points are hardened and ground generally to a 30-deg. included angle taper. In a grinding head of this type the spindle can readily be removed for changing wheels when occasion requires.

Grinding Various Rolls

In grinding rolls that do not call for a very fine finish, two carborundum wheels in vitrified bond are generally used at the same time, one on either side of the roll, both being 60-grit K grade, B-4 bond. Where two wheels of the above grit, grade and bond are used under favorable conditions, they will remove 0.006 in. at each pass of the roll, thus a roll 24 in. long, with 0.125 in. to remove can be ground in about 20 passes. In feeding the roll past the wheels at the rate of 18 in. per minute, which is common practice, the time to grind a 24-in. roll of average diameter is about 30 minutes, counting in the time consumed in the reversal of the carriage at each end of its stroke.

In grinding rolls that call for a fine finish I usually suggest the use of two carborundum wheels in shellac bond, one on either side of the roll; 30- to 60-grit, 2 grade, I-5&C bond. As the shellac bond makes a tough, and at the same time a free, cutting wheel, it gives excellent results in removing the worn corrugations from the breaking-down rolls used in flour mills preparatory to recorrugating them.

Grinding on the Cylindrical Grinder

Rolls can, of course, be ground on an ordinary cylindrical grinder locating them from the centers. If this method is followed only one wheel can be used. Therefore the cut cannot be so deep, or the feed as coarse as in the case where two wheels are used on the regular machine as designed for roll grinding. Another objection is that too much time is consumed in changing the heavy grinding wheels on a regular cylindrical grinder large enough to take rolls 20 to 36 in. long. Again the initial cost of the wheels is high as compared to the cost of the smaller wheels used on regular roll grinders. These are a few of the reasons why rolls are generally ground on machines built for the purpose.

Type of Roll Grinder Generally Used

Many will argue that a roll cannot be ground perfectly round by locating from the necks. This is true in cases where the necks are badly worn or out of round. If a roll with badly worn necks is located from the centers and ground, the body will, of course, be concentric with the centers and then the journals will have to be ground to bring them concentric with the centers and the body of the roll.

Before a roll is to be ground on its journals in a regular roll grinder, the operator first tests the journals to make sure that they are round and that they run true. If they are not, he grinds them on centers and then proceeds to grind the body of the roll in the regular way by locating from the journals, as shown in the illustration.

The manufacture of cars for steam railroads demanded the employment of 43,986 wage earners during the year 1909, according to a bulletin just issued by the Census Bureau. This showed an increase of 28.8 per cent. over the number employed during 1899.

The Training of Draftsmen*

By F. G. Higbee†

Primarily a draftsman must know how to draw. He must acquire early in his training a mastery of the technic of drawing; he must know how to execute neat and legible letters and numerals and how to make clean-cut and crisp lines. And this he must be able to do with speed and sureness on both detail paper and tracing cloth. In acquiring this knowledge accuracy must be insisted upon, a high quality of work must be demanded and a reasonable individuality of execution should be encouraged. Following this the work in drawing should be enlarged to include methods of representation by projection, problems in dimensioning simple drawings, and free-hand sketching.

These subjects may be taught in the high school and when properly presented they are well within the grasp of the average fourth-year, high-school student. The amount of time required for this work should depend entirely upon the needs of the individual and his ability to grasp the subject. Too often is the mistake made of attempting to teach drawing to a group of boys within a given time, when it is obvious that the personal factor of each individual and his rate of progress are the elements which should determine the amount of time required. If a student shows normal development the amount of time he requires for this development is entirely secondary to the great factor that he is developing.

Shop Methods

While this elementary training in drawing is going forward the embryo draftsman should be learning shop methods. It is in this part of his education that industry may step forward to ally itself and its forces on the side of education. In whatever way expediency and circumstances may dictate the boy should be allowed and required to enter some shop or group of shops where in turn he may learn by observation and actual practice pattern making, foundry practice, forging, machine work and machine operation.

At first thought it may seem to a shop manager that such a boy or group of boys could not fail to be but a nuisance. There can be no doubt that such a group would not be the source of much earning capacity, yet it must be apparent also that they would neither be the source of much expense. They would no doubt do enough work and be of enough use to at least pay for the trouble and expense of their training, and as future possibilities they would soon become potential assets. Such work

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*Abstract of a paper presented to the American Society of Engineer Draftsmen.

†Head of the Department of Descriptive Geometry and Drawing, Iowa State University.

on the part of shops must be at first largely philanthropic, yet in time the advantages, derived from having always at hand a home-trained and home-established body of young workmen from which recruits may be drawn, would more than offset the disadvantages occasioned by their training.

While their knowledge of shop methods is progressing, more advanced work in drawing may be taken up. From existing machines and machine parts, drawings should be made and checked and blueprinted. From such a beginning the work may gradually be developed into an approximation of drawing-office methods, and in time filing and indexing of tracings and prints should be discussed and drawing-office methods and management should be explained.

Mechanism should be studied next. Pulleys and belting, gearing, mechanical movements, fastenings, bearings and lubrication and the elements of machines should be taken up in turn and discussed in a practical way. Frequent visits should be made to local shops in order to examine these things under actual working conditions. Simple problems should be worked out on the drawing board not only to fix the principles of these mechanisms in the mind, but also to provide constant practice and develop facility in the use of the drawing tools.

Materials and Machine Design

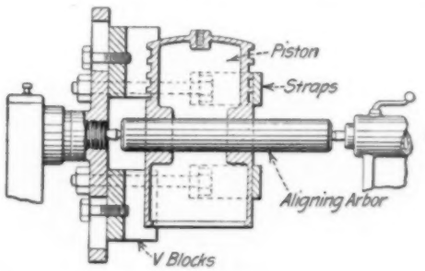
Some knowledge of materials is essential to every draftsman. The properties of engineering materials can be explained to any interested young student who has had experience in working with them. This explanation need not be of a highly theoretical nature, but it should be practical and thorough. Simple problems in the strength of materials may be worked and while the computations involved in work of this character must of necessity be of an empirical nature, yet they will serve to give the pupil a very useful and practical working knowledge of the subject.

The training of the draftsman should be concluded with a course in machine design. Too much importance cannot be placed upon this work for it is here that the student has the opportunity of coordinating all his previous studies, and of applying the knowledge he has acquired in a practical way. Existing machines should be studied and analyzed into their elements; these elements may then be redesigned and thus the student learns to apply his knowledge of materials, of mechanism, of shop practice, and of drawing.

It has been presupposed that during the study of these technical subjects, preferably before, the usual high-school course has been pursued. Mathematics especially should be emphasized and of this subject no part is more useful, practical and essential than arithmetic. Too often is it neglected, or passed over in a superficial way, as being of secondary importance. Plane and solid geometry should be studied as drawing-board problems. Trigonometry and logarithms should complete the course and problems in this work should be computed by means of the slide rule.

Chemistry and Physics

Chemistry should be studied. Practical chemistry. The manufacture of iron and steel, the composition of alloys, and the reduction of metals from their ores; the origin, use, and composition of fuels and coals; the properties and composition of oils and lubricants; the chemical effects of heat; these and other matters of vital importance commercially, are subjects to interest any young man and they may be presented to him in a manner that will at once win his interest and inform his mind.



Aligning and Boring Wristpin Holes

Physics too must be taught. Not theoretical physics, but the practical application of electricity and magnetism, the laws of gases and vapors, hydrostatics, and the great physical laws which are the foundation of all engineering work. Hard as these subjects are usually found they may be studied in a way which will arouse the interest and inspire the earnest effort of any young man who is anxious to learn.

English

The study of English should never be overlooked or neglected. Its proper use is as essential to every man who would win the respect and confidence of his associates as his knowledge of the technical subjects, and no training can be complete without a knowledge of how to use it as a written and spoken medium of expression.

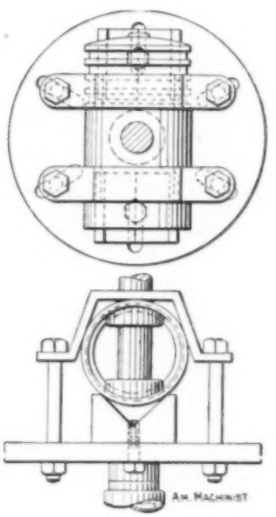
This, then, is the instruction which should be provided for the training of draftsmen. It is not to be expected that such a training will fit a man for any but the subordinate positions in the drafting office, yet it will do that and at the same time it will provide him with a foundation upon which he may build to whatever dimensions his ambition may inspire him. The mathematics, the chemistry, the physics, the English, and the elementary drawing are subjects which may be taught as a part of the regular high-school curriculum; the more technical and advanced subjects should be taken up as a supplement to the regular work and additional time should be allowed for their mastery.

Aligning and Boring Pin Holes

By George F. Long

The cut illustrates a method I devised to bore the wristpin holes in the piston, when worn out of true, or when a wrist pin seizes or roughens the hole.

In some makes of cars the wristpin is fastened to the connecting rod and is free to move in the piston, which in a short time becomes oval. The result is a constant knock which in time becomes serious.



For this style I have used this fixture, though it can be used for any gas-engine piston, to bore the wristpin hole round, parallel and central with the circumference.

Two V-blocks are held to the faceplate of the lathe by two bolts shown at back in the cut. The piston is then clamped to the V-blocks by the two straps and the bolts shown. To align the old hole in the piston I put an arbor through it and place it between the centers, then clamp to the V-blocks as shown, and withdraw the arbor, when it is ready to bore. For greater accuracy I then use an indicator.

The six gas engines being installed as the initial group in the new power house of the Indiana Steel Co. at Gary, Ind., are the largest units ever constructed, and have a rating of 3200 kilowatts (4288 hp.) each. The new engines are of the twin tandem double-acting Allis-Chalmers type, with cylinders 44 by 60 in. The engines will operate on blast-furnace gas, and are to drive alternators delivering 6600-volt, 25-cycle, 3-phase energy to the power network of the Gary mills.

Dies for Primary Battery Parts

Editorial Correspondence

The shop practice of Thomas A. Edison, Inc., in forming the metal parts of primary batteries.

Blanking, channeling and piercing dies and an unusual form of bending punch and die.

It will be of interest to our readers to know something of the punching dies and forming tools which are used in the manufacture of the Edison BSCO primary cell, by Thomas A. Edison, Inc., Orange, N. J. These cells are in service along thousands of miles of our railroads, operating signals, crossing bells and the like, and are also largely used for gas-engine ignition, telephone circuits, small power motors and many other purposes where a long-lived, constant-current battery is a necessity.

The cell is made up of a copper-oxide plate, suspended between two zincs in a solution of caustic soda. The methods of making the frames and parts for suspending and assembling these plates will be shown, but as it is outside the scope of this article, the making of the battery plates themselves will not be gone into, except to state that the zinc plates are cast in double molds and the copper-oxide plates are pressed up in hydraulic presses.

The frames, crosspieces and clamps used to hold the parts of the battery together, are all made of sheet steel, heavily copper plated to prevent corrosion. In order to give the reader a better idea of the battery construction, a complete set of separate parts is shown in Fig. 1, with an assembled set at the right. In this half, *A* and *B* are the zinc plates, showing opposite sides; *C* is the copper-oxide plate; *D* is the metal frame for the copper plate with the crosspiece and suspension bolt in place.

The method of fastening the bolt to the frame at *E* is worth noting, as a solid union is obtained without the use of solder. *F* and *G* are porcelain separating pieces used between the plates.

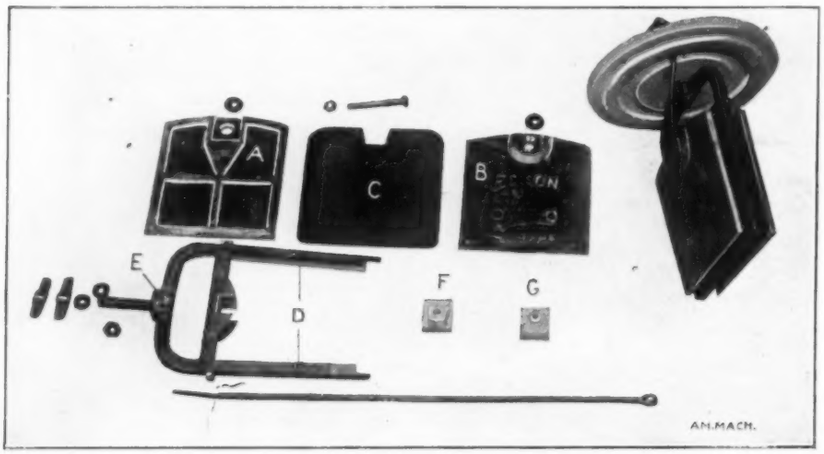


FIG. 1. PARTS OF AN EDISON PRIMARY BATTERY

DIES FOR MAKING FRAMES

The frames are first blanked out from drawn strips of the proper width, with the punch and die *A* and *B*, Fig. 2, the strips being fed from a reel under the stripper *C* against the stop *D*, the punch forming a double-ended tongued strip like *E*.

From the blanking dies the pieces go to the subpress channeling die *F*, the punch for which is at *G*, and are formed as shown at *H*, though the holes *I*, *J* and *K* are not pierced as the halftone indicates, but are done in the next operation, the pins *L* and *M*, shown, being merely spring-actuated knockout pins.

PIERCING AND BENDING

The channeled strips are next placed in the die *A*, Fig. 3, against the stop *B*, and the three holes, just referred to, pierced by the punches *C*, *D* and *E*, and then bent, as shown at *F*, in the die *G*, by being forced down into the die by punch *H*. The piece is located in the die by the spring pin *I*, which fits the punched hole in the middle of the channel.

The forming punch is narrower at the top, so that the bent piece will cling to it at it rises, and the punch holder is swiveled, like the clapper of a shaper, on a pin which passes through the hole *J*, so that the punch may be easily swung outward by turning the handle *K* of the locking device and pulling outward on it, when the bent piece is easily pulled off

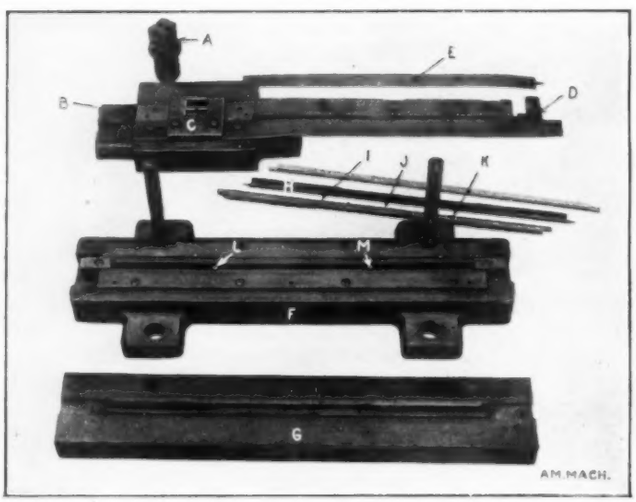


FIG. 2. FRAME BLANKING AND CHANNELING DIES

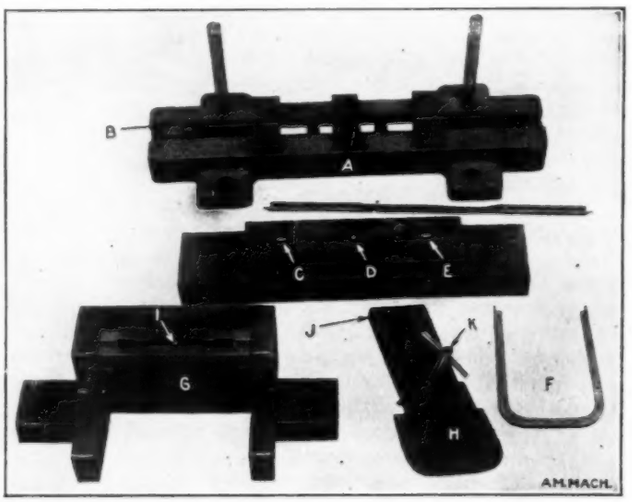


FIG. 3. PIERCING AND BENDING DIES

by hand. This device obviates many of difficulties usually encountered in shaping a piece of this type in an ordinary press.

Making Crossbraces

The frame crossbraces, which are used both to stiffen the frame and to hold the zinc plates in place, are blanked out as at

Fig. 4. Cross Brace Blanking and Forming Dies

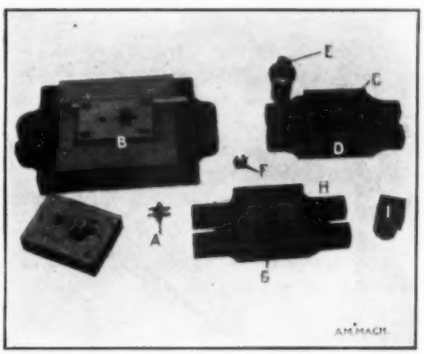


Fig. 5. Spider Clamp Forming Punches and Dies

A, Fig. 4, with the die and punch *B* and *C*, then the middle finger on each end is bent up, as shown at *D*, the piece being placed in die *E* on the spring plate *F* and forced down with the punch *G*, the two plugs *H* and *I* forcing the fingers up as shown.

The next operation is to channel the pieces and bend the outside fingers together, as shown at *J*. This is done in the die *K* by forcing it down by means of the punch *L*, which forms the channel first, then as it forces the piece deeper into the die, the two end pieces *M* and *N* push the fingers together by crowding them down into narrow V-topped slots.

These may now be assembled in the frames by springing them in so that these compressed fingers enter the slots in the sides of the frame, when they are spread and locked in by using a chisel-shaped tool for the purpose. This last operation is done after the oxide plate is assembled in the frame, thereby tightly clamping in this plate and insuring good electrical contact along its edges.

Forming the Spiders

The spiders used to give the cover bolts a firm hold on the frame are first blanked out, as shown at *A*, Fig. 5, in the die *B*, then the legs are bent up by placing the blank on the spring plate *C* and in the die *D* and forcing them down with the punch *E*, the spring plate throwing them out as the punch rises, the bent piece, looking as at *F*.

The two legs that fit over the outside of the frame are bent inward about 15 deg. in the die *G*. The spider is placed legs down over the spring pin *H*, and is forced down with the punch *I*, the slots into which the two legs fit being beveled so as to force them inward. As the punch rises the spring pin throws the piece up where it can easily be removed by hand.

Assembling Spider to Frame

The spider, after being formed as indicated, is forced into place, as it is a drive fit. The wedge-headed bolt is also driven up from the underside of the frame, the wedge overcoming the inward spring of the bent-in broad legs of the spider. A large round spanner nut is then screwed down firmly, holding all the parts together so solidly as to practically be a part of the frame itself.

Recutting Spiral Fluted Rolls

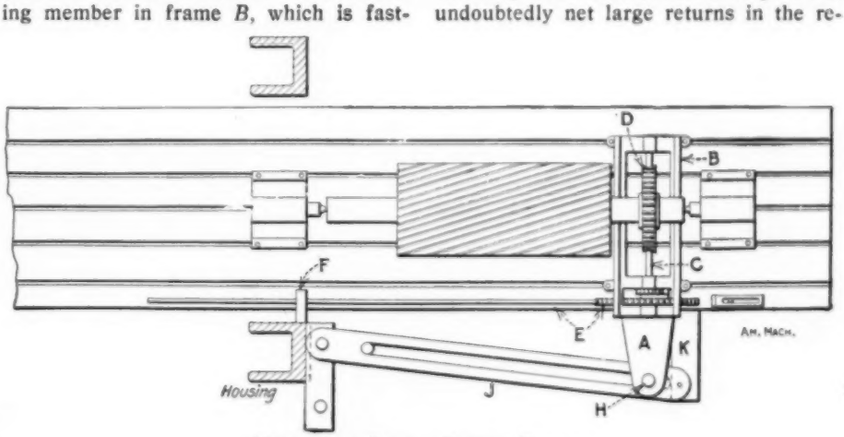
By E. W. Tate

Having some spiral-fluted rolls to recut, the following arrangement was used:

The roll is secured to the planer platen between two center heads. *A* is a sliding member in frame *B*, which is fastened to the planer platen. Secured to the shaft *C*, directly below the worm gear *D*, is a worm of ample length. Assembled on the end of shaft *C* are a pinion, ratchet and pawl; the pinion meshing with the rack *E*. Attached to the rack is a cold-rolled rod which passes through a friction collar, contained in the bracket *F*.

Bracket *F* is attached to the housing of the planer. The friction collar holds the rod and rack for a predetermined period while the platen is moving, thus revolving the pawl over the ratchet on the return stroke of the planer and revolving the shaft *C* at the start of the cutting stroke, thus indexing the roll just before the tool begins its cut.

The rotating of the roll, forming the spiral, is accomplished by roll *H* following the slot in the bar *J*, which is swiveled at one end and secured to the base of the planer at the other end by bracket *K*, the worm and worm gear acting as a rack and spur gear respectively. The bracket which is attached to the housing is of ample length to allow of two positions for that end of the bar *J*, so that spirals of either hand may be cut. The ratio between the ratchet and the worm gearing is such that a number of different divisions may be indexed, so that a few ratchets will accommodate a great number of divisions.



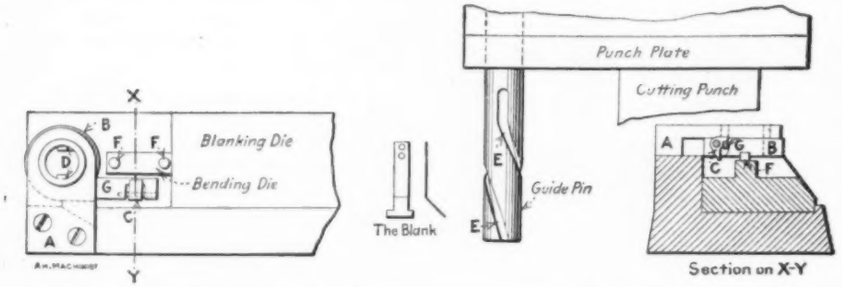
Recutting Spiral Fluted Rolls

We speak of reclaiming serviceable material from scrap, and it is true that large savings have been effected by sorting over parts which have been cast aside by workmen and foremen as no longer of use, but with the proper organization in shops, engine houses and car departments serviceable material should never reach the scrap pile. It is only possible to educate workmen within a limited range as to the importance of conserving material, and we should no more expect our mechanics without direction to exercise proper care in its use than we should expect to operate our shops without the supervision of foremen. Foremen may and should be carefully instructed as to the use of materials, and intelligent, carefully directed effort on their part will undoubtedly net large returns in the reduction of material charges. The paramount duty of the foremen, however, lies in the supervision of labor, and their efficiency in this line should not be impaired by imposing upon them too many additional duties. The foreman's first thought should be for expedition and quality in the performance of the work, and he may at times condemn certain parts (which parts may be easily and inexpensively placed in serviceable condition) in order to avoid delays, or to improve the quality of repairs.—*American Engineer.*

Knockoff for Combination Dies

By M. H. P. Allen

In building combination dies for various electrical parts, bicycle parts, etc., it is frequently necessary to incorporate some device for removing the part after it has been worked on by the different punches. This is usually termed the knockoff.



Figs. 1 and 2. Knockoff for Die on Noninclinable Press of Short Stroke

By having the press inclined, gravity will often supply the force necessary to remove the finished part, without a knockoff. But in the case of parts having projecting lugs, bosses, etc., or of a form that clings to the die, some knockoff device is essential for rapid production.

In Fig. 3 is shown a common form of knockoff, the action of which hardly calls for a description. The cam *A* is pivoted in the forked rod *B*, on the pin *C*. A small spring returns cam *A* to the position shown, after it is swung back, on the down stroke, by the rod *D*.

The particular feature in this device to which attention is called, is the hole *M* in the end of the plunger *D*. This is to weaken the plunger so that, should it be caught between the bending punch and

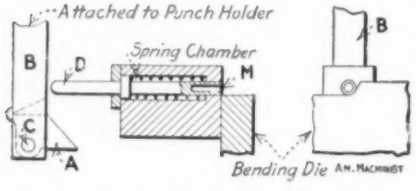


Fig. 3. Common Form of Knockoff

die, it will cause no damage, but simply flatten out. It is cheaper to replace the plunger than the die.

A knockoff for a die, which is used in a noninclinable press of short stroke, is shown in Figs. 1 and 2. This combination die has two subpress pins, one only of which is shown. This one has a couple of cam grooves, 180 deg. apart. The knockoff consists of a flanged collar *B*, having an arm *G*, on which is hinged the catch *C*. The collar *B* works in a bearing *A*, which is concentric with the bushing for the guide pin. Two short pins *DD*, in the collar *B*, engage with the cam grooves *EE*. These grooves are a uniform spiral for most of their length, but end in a short dwell at the upper end. As the pin goes up in its bushing in the lower die, it imparts a circular motion to arm *G*, causing the catch *C* to sweep over the bending die and carry with it the formed blank resting on the spring pins *FF*. This is reversed on the down stroke, the hinged construction of *C* allowing it to swing over the part of the stock which lies over the bending die, waiting to be cut off and bent.

This knockoff throws the pieces clean off the die. The speed of the press and radius of the arm gives *C* a good velocity. It is more suitable for presses of short stroke, as the pins in the collar *B* must always be in engagement with the cam grooves *EE*. With a long stroke this means a long pin. The collar *B* and the bearing *A* are hardened and ground.

Trade with South Russia

The working of the South Russian market presents considerable difficulties. In particular may be mentioned the large importation into Russia from Germany and other countries, the efficiency of Russian industry and the tariff conditions. Selling conditions, particularly those of payment, are likewise so difficult in South Russia that only commercially experienced firms can succeed. A sharp warning is necessary for mercantile beginners.

The best means to work successfully the South Russian market are the right sort of traveling men and agents, who must supplement each other's duties. The first impulse must be given by commercial travelers, who, before all things, should have an accurate knowledge of the facilities of the factories they represent. The Russian customers are tied up to their traditions and lack sufficient initiative in themselves.

The activity of the traveler must be supplemented by local agents who understand the tariff, the state of competition, and the credit of the purchaser. The traveling man must adjust himself to these matters before he goes after the customers. After his trip is over, the local agent has control of the customers and takes new orders. The large agency firms in Russia possess, in addition to traveling representatives, a carefully considered and practically tested organization of subagents, with whom they have covered all of South Russia.

Representation by such a large and trustworthy agency offers favorable selling possibilities. Since the traveler must be a confidential person of the manufacturer, it falls to him to supervise the local agents. Not seldom the heads or managing directors of large German firms come to Russia in order to make their own observations of the personality and conditions to be found there. Such a method is very profitable and cannot be too strongly commended to attention.

Since under Russian conditions the firms find local agents very necessary, and since in particular a withdrawal of the representation always causes damage, the selection of agents requires great foresight. Special care should be observed in treating agents who offer and recommend themselves on the ground that they have a clientele of customers.

German machine builders have established in Odessa warehouses for their products, which are managed by quite independent, employed officials of the factory. The managers of the warehouses have in part an excellent commercial, in part a good technical training; they know the productive capacity of the factory and the conditions of the selling market. On similar principles rest the three warehouses of American agricultural-machinery manufacturers. This plan of organization for selling machinery has justified itself and can be generally recommended.

The German export trade has often, for equal output production, outstripped the competition of other countries by reason of liberal credits. This obliging practice is rendered possible only by regularly obtaining correct information of the reputation and reliability of every customer, presented by the local agents. It is absolutely necessary to pick out with thoroughness and care from the great body of customers the comparatively small percentage which deserves credit.

From the great mass of customers an attempt should be made to obtain cash payments. It is a common artifice of the unreliable trades people to object under flimsy pretenses to goods shipped on credit, and thus to beat down the price by placing before the seller a choice either of taking back his goods at his own expense or making price concessions.

Further, there often occurs the subterfuge, where an untrustworthy local agent, in collusion with the customer and forwarders, enters the goods, and then the customer groundlessly refuses to accept them. The shipment is then, after a while, sold at auction by the tariff officials and bought in by the customer at a spot price. Against this sellers may protect themselves by confining their dealings to reliable forwarding firms.

Grinding and Corrugating Rolls

By F. A. Stanley

Methods of handling chilled iron rolls in an Omaha shop where the surfaces are ground true by rotating the work upon its own journals, and the corrugations are formed by a series of tools carried upon an hydraulically operated table.

The roll is held vertically during the grooving operation and is rotated through the required arc to produce a helical corrugation of any desired angle.

One of the departments in the shops of the Sunderland Machinery & Supply Co., Omaha, Neb., is devoted to the grinding and corrugating of chilled iron rolls used in flour and feed mills. Two views in this department are presented herewith. Fig. 1 shows two grinders and one of the vertical corrugaters, while Fig. 2 gives a somewhat better view of the corrugater by itself.

The grinders are adapted to carry the rolls upon their journals, after these have been trued up; the boxes in which the journals rotate will be seen clearly in Fig. 1. The spindle has a direct drive by means of a large narrow-face pulley belted from a small pulley overhead, the spindle and roll are connected by a floating driver so that the work depends entirely upon its journals for accuracy of rotation. This enables the rolls to be ground to a true cylindrical surface preparatory to the operation of cutting the corrugations.

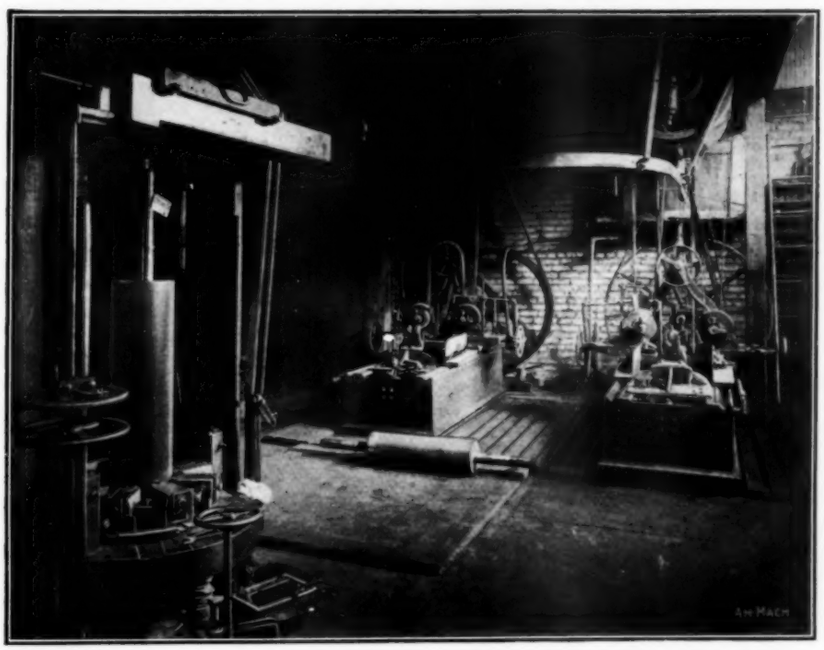


FIG. 1. ROLL GRINDERS AND A CORRUGATER

THE CORRUGATER

Referring to Fig. 2, where the roll is shown in a vertical position, it will be seen that the corrugating tools are carried by a circular table, which travels up and down over the work while the latter is held against end motion. The roll is, however, rotated for helical corrugating, by means of the adjustable guide bar at the right, so that any desired angle of helix may be obtained. While practice with rolls for different purposes varies more or less, the angle of the corrugations will range ordinarily from about 1½ to 5 deg.; that is, the helix on different rolls will depart from an axial line from ¼ to 1 in. per foot of length.

Sometimes the rolls are cut with wave corrugations, sometimes they are corrugated straight from end to end. In any case with a plain helix, and whether right- or left-hand helix is required, the guide bar at the right side of the machine controls the rotary movement of the roll. Where a wave corrugation is required, the guide bar shown is changed for one which will produce the necessary forward and backward roll movement, so that the roll surface will present the appearance of a fine-tooth, low-angle, broad-face, herringbone gear.

It should be noted here that the angularity of the setting of the guide bar produces a corresponding degree of rotation of the roll through the medium of a sliding rack at the top of the machine, which acts upon a gear to which the roll is connected by a driver. The rack is slid to and fro by a shoe, which is a sliding fit in the channel in the guide bar.

The rolls will usually range from 6 in. in diameter by 12 in. in length to 9 in. in diameter by 36 in. in length. Some, however, are as large as 12 or 14 in. in diameter.

MACHINE DETAILS

The circular table for the corrugating cutters is operated hydraulically and at a travel of about 2 ft. per min. It carries eight tool holders equally spaced about its face and these holders are so constructed as to rock upon the return stroke to clear the cutting edges of the tools. The tool holders are adjustable radially in their blocks to allow the tools to be fed in to the work, and the blocks themselves are very accurately located by tongue and groove on the table so that the teeth on the eight tools shall cut corrugations in perfect register with each other.

The index mechanism is mounted on the vertical shaft at the left of the machine, and may be set to suit any pitch of corrugation required. The roll is advanced one tooth at a time at the end of

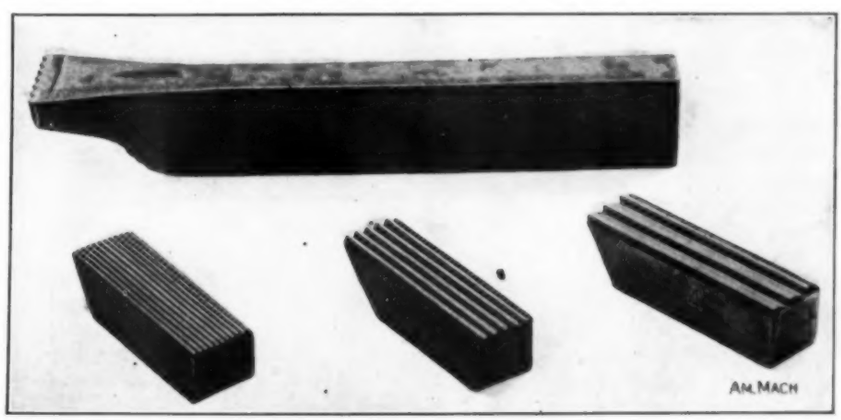


FIG. 4. CORRUGATING TOOLS AND A MASTER PLANING TOOL

each complete stroke of the table and the table-index movement given the roll is from one tool to the next, or one-eighth of its total circumference.

After this series of forward steps is completed, the roll is indexed back to the starting point, and another series of cuts taken in the corrugations. This process is repeated several times to complete the corrugating operations, the exact number of cuts being determined by the pitch of the tooth, the form of corrugation, etc.

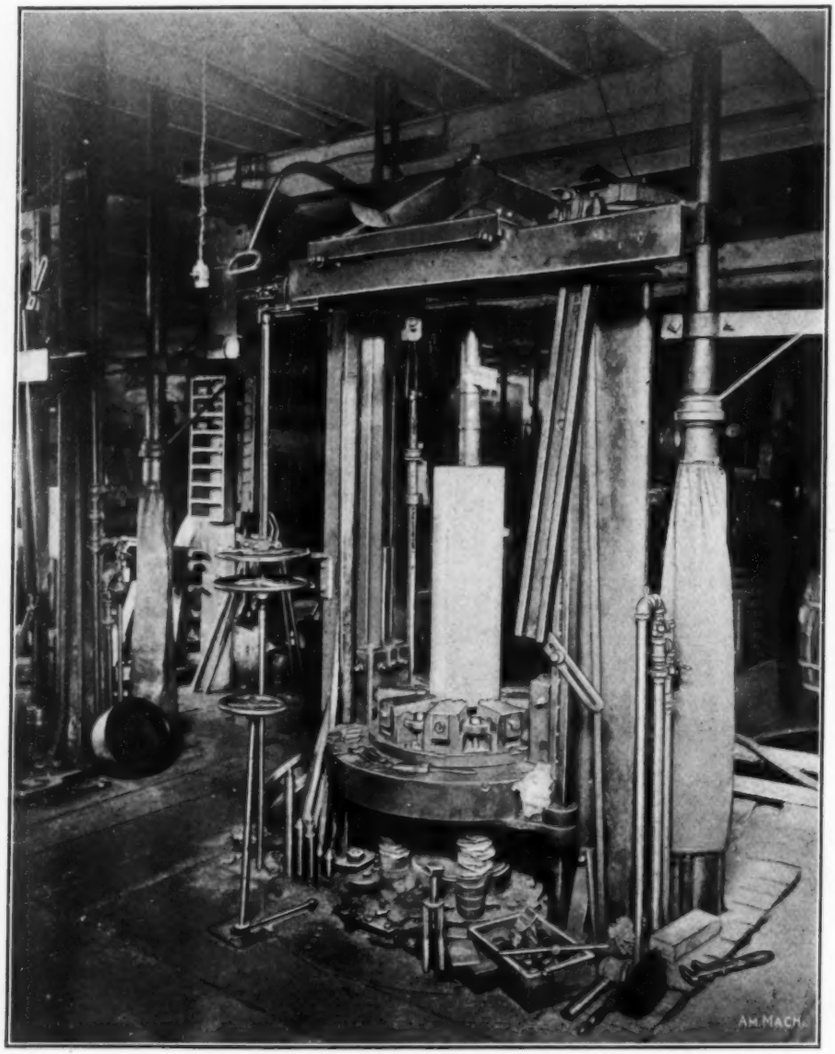


FIG. 2. ROLL GRINDER

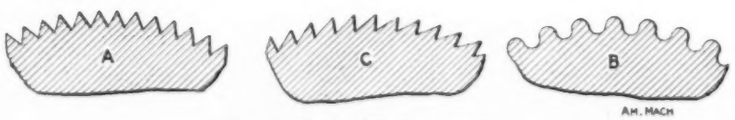


FIG. 3. ROLL CORRUGATIONS

TYPES OF CORRUGATIONS AND TOOLS

Three forms of corrugations are shown in section in Fig. 3. The V-tooth at *A* and the round form *B* are alike on both sides, and rolls with these corrugations will work in either direction. With teeth of either of these sections the corrugations may be straight, helical or waved. The saw tooth at *C* is not a practical one to cut where a wave corrugation is desired. All milling rolls are cut to some one of these corrugations, or to a modification or possibly a combination of these forms.

Three tools of different pitches and for V- and saw-tooth corrugations, are illustrated in Fig. 4, which also shows a planer tool for finishing the corrugating tools. The tools are carried at an angle in their holders with the cutting end square with the roll surface, and when dull are ground across the end the same as the familiar form tool used in screw-machine practice.

The tools are made for pitches ranging from 4 to 40 per in. They are ¼-in. square, and are of a special grade of steel, which enables the cutting edges to stand up and form a smooth corrugation in spite of the hard surface of the roll.

A Man Capitalized

In a statement issued to the employees of the road, President H. U. Mudge, of the Chicago, Rock Island & Pacific, capitalizes each man earning $83.33 a month, or $1000 a year, at $25,000, because the man's wages or salary is the interest at 4 per cent. on $25,000. He says a man earning that much is worth as much as a locomotive costs, but he adds:

"You can make yourself worth more, while a locomotive cannot. You can direct your own energies, while a locomotive must be directed by a driver. It rests with you to raise your own capitalization to $50,000, to $100,000, or even to $500,000. Therefore be careful about your food, treat your body decently, and, above all, feed your mind. Your are working for a large corporation. In the nature of things it cannot know you very well personally, but it knows you by the work you turn out. It sets a real value on your work, higher than you think. Your value is measured by the quality and quantity of results you produce. Somebody knows your actual worth, appreciates your honest endeavors and has you in mind for better things. It is a business proposition. Each of us is capitalized."

An Artificial Pumice Stone

Natural pumice is so common to volcanic eruptions that after such outbursts the surface of the adjacent seas has been covered for miles with a mass of the floating stones.

The material is a kind of glass (obsidian), which, while in a molten state, has been rendered porous by the expansion of gas or steam in its substance. This familiar stone has always been useful in the arts, but it is not a reliable compound, for it will vary both in grain and hardness, sometimes in the same piece.

This suggested some time ago the introduction of an artificial stone that would answer the same purpose as natural pumice without its faults. This product is made at Bietigheim, in the valley of the Enz. Its constituents are sandstone and clay, and there are said to be no fewer than ten different grades of the stone which are manufactured.

There is a hard and a soft kind designed for the leather, felt, and wood industries; another kind for stucco workers and sculptors; soft, finely grained variety for polishing woods and for tin goods; another kind suitable for treatment of lithgraphic stones; while other varieties of the artificial pumice are fitted for various duties.—*Stone.*

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Making a Losing Job Pay

A disassembled view of a job which has come to us for several years, and on which we failed to make a profit until this year, is shown in Fig. 1. The part shown is a screw and nut used to hold large calendars together where only one number appears on a page.

The factors in cutting the costs on this job and making it profitable were the purchase of a rotary electroplating ma-

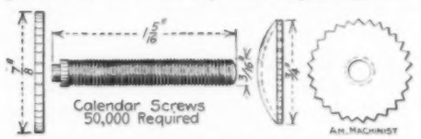


FIG. 1. CALENDAR SCREW

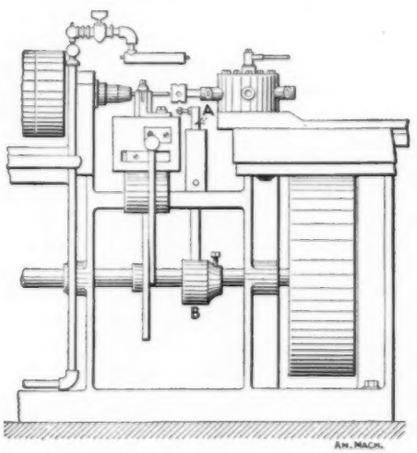


FIG. 2. ARRANGEMENT OBVIATING NECESSITY OF REVOLVING TURRET

chine to replace the old basket method, the use of apprentice boys whenever possible on the automatics cutting the screws and on the tapping and riveting machines, arranging a stop on the automatic for stopping the stock in the proper place and a tapping fixture for holding the nuts.

At *A*, in Fig. 2, is shown a slide in the top of which is a screw locked in position with a lock nut and which has a hardened head, against which the stock strikes for its correct length. *B* is a two-point cam which raises the slide *A* at the proper time. A spring causes the slide to drop as the cam recedes. The turret then moves forward, carrying a geometric tool die. This arrangement obviates the necessity of the turret revolving, as it carries only one tool, thereby saving considerable time.

A tapping fixture mounted upon a sensitive drill press is seen in Fig. 3. The nuts, which are in a bucket of oil convenient to the left hand, are placed upon the plate *A* with the convex side up and fed into the jaws *B* and clamped by pressing a foot lever while the right hand operates the drill-press lever.

A tapper tap which will hold about 40 nuts is held in a Grönkvist drill chuck. For the benefit of anyone who is not familiar with this chuck, it should be said that it allows drills or taps to be taken out or put in while running. When the tap is full, it is taken out and the nuts dropped off the shank end and replaced in the chuck without stopping or reversing the machine and backing the tap out of each nut; a practice common on tapping machines. It is obvious that here is another large saving in time.

Indianapolis, Ind. G. W. LINN.

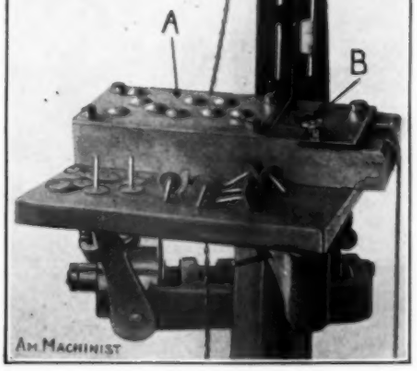


FIG. 3. TAPPING FIXTURE ON SENSITIVE DRILL PRESS

Forging Solid Locomotive Axles

The steel ingot for the crank axle of a locomotive engine, 4 ft. 8½ in. gage, and for a stroke of 26 in., is square and weighs about 10,000 lb. The ingot is "slabbed" to 24x12 in. under a steam hammer, and in the same heat the ends are cut off to make the slab the required length, and the "sweeps" cut with a circular saw. The slab is then reheated and the lumps cut out between the "sweeps" and from the ends for the bearings and plain portion in the middle of the shaft, and are rounded up.

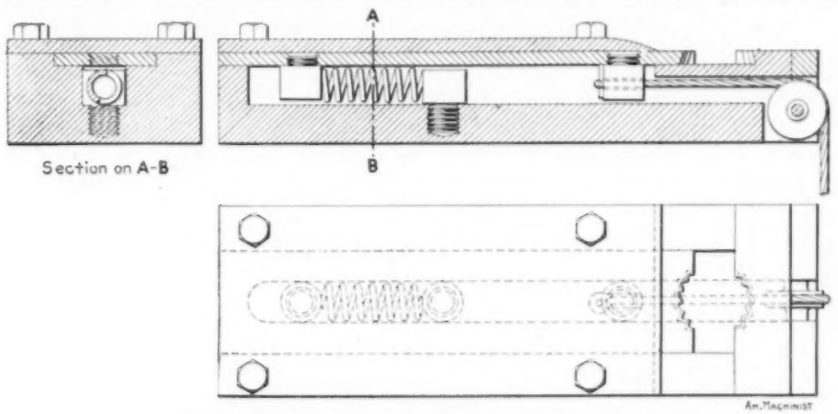
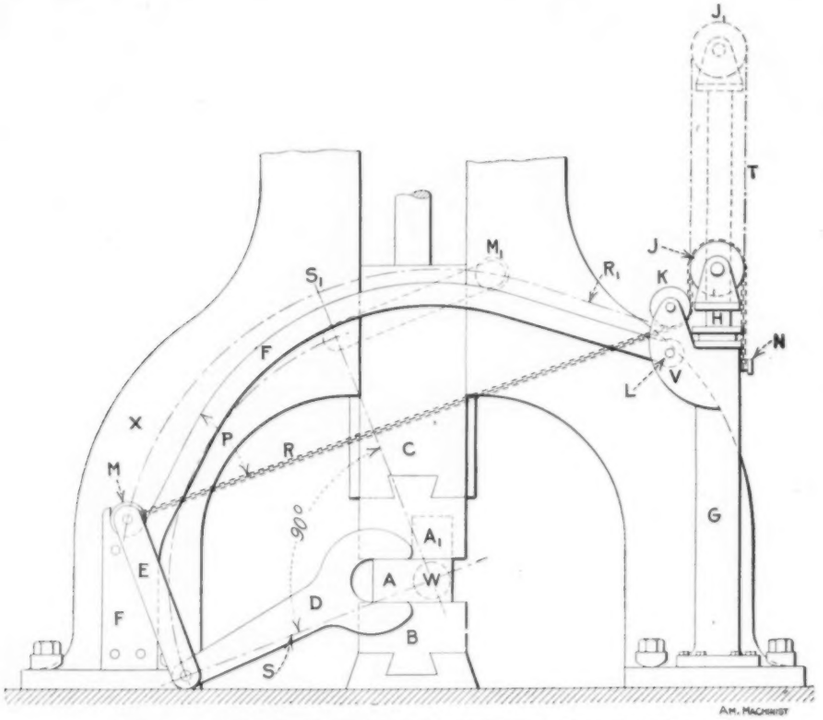


FIG. 4. TAPPING FIXTURE FOR CALENDAR NUTS

The forging is now ready for twisting 90 deg.—one "sweep" or crank at a right angle with the other, being reheated for this purpose. The twisting operation is performed by holding one "sweep" between the hammer, anvil and tap; upon the other "sweep" is placed a large wrench to which is hooked the bottom block or sheave of the jib crane, which serves the hammer. All the helpers (generally 10) then get to work on the crane handles and thus pull the spanner around 90 deg.

I designed a very much easier method for the twisting operation, which also made it unnecessary to reheat the forging for the purpose of twisting, thus saving one heat, which is an item worth considering, as it reduces the total cost of the forging. The following describes the method and "rig" for the purpose.

A hydraulic cylinder is secured to the hammer framing on the right-hand frame as one stands facing it when placing the forging on the anvil. At the top on the outer side of the cylinder is cast a half dummy chain pulley, and on the opposite side are cast two brackets to carry two chain pulleys. The end of the hydraulic ram is also constructed to carry two chain pulleys.



APPARATUS FOR FORGING SOLID LOCOMOTIVE CRANK AXLES

Secured to the framing of the hammer and to the hydraulic cylinder is a specially formed bar, this bar being the path over which the end of a link attached to the spanner passes, so that the link shall always be a right angle to a line drawn through the axis of the neck to be twisted and the pin hole in the end or tail of the wrench and thus get the maximum pulling force at work on the spanner due to the upward motion of the hydraulic ram.

When the wrench was pulled around with the jib crane without the guide bar just referred to, the direction of the pull formed, during the first part of the twisting, an acute angle and during the latter part an obtuse angle, thus reducing the efficiency of the power used for turning the wrench.

With the new arrangement when one end of the forging is placed under the tap on the anvil, the wrench is put on it and attached to one end of the link, the other end of which is mounted on a pulley resting upon the guide bar. The hammer driver goes over from his driving position to open the hydraulic valves. When all is ready the order is given. The valves are operated, the ram ascends, pulling the link along the guide bar and thus twists the "sweep" upon which the wrench is placed a quarter turn. The neck which has been twisted is then finished with swages, thus completing the forging.

The diagram is an elevation of the arrangement, *G* being the hydraulic cylinder, *N* the dummy half pulley cast upon it, and which resists the pull of the double chain *T*. *H* is the hydraulic ram with two pulleys *J* mounted on the end. A pair of brackets *V* carries a pair of guide pulleys *K* for guiding the chain, the brackets being cast upon the cylinder. The guide bar *F* is secured at the bottom end to the left-hand hammer frame in such a position that the end of the wrench *D* will clear it; the top end is secured to the brackets *V* at *L*.

The first portion *X* of the guide bar *F* is formed so that angle *P* shall be less than 45 deg. with the line *R*, the other portion is an arc of a circle described from a point which coincides with the center of the neck to be twisted at *W*. The two ends of the chain *T* are attached to the axle of the pulley *M*, which also carries the link *E* and rests upon the guide bar *F*. The bottom end of the link *E* is attached to the end or tail of the spanner *D* on the sweep *A*. *B* is the anvil and *C* is the trip which holds the forging in position, like a vise, during the twisting operation.

Line *S* is the initial position of the wrench, and the line S_1 is the position when the crank *A* has received a quarter twist. The broken line *R* represents the position of the chain when it begins to pull and R_1 at the finish, also J_1 the position of the pulleys *J*. M_1 shows the final position of the link *E*. A_1 shows the sweep twisted.

WALTER HEAP.

Southport, England.

Casting with Inadequate Foundry Equipment

In the diagram is shown how a cast-iron tank of unusual proportions and dimensions was made in a small jobbing foundry in a country town where flasks and foundry equipment were few and the core oven was built for taking care of small jobbing pieces only. The foundryman was anxious to make a casting, yet he did not care to go to any extra expense beyond the flasks, etc., on hand. How the mold was made with the three sections of flasks is shown in the diagram.

The dimensions were as follows: Length, 10 ft.; depth, 3½ ft.; width of flange, 7 in.; thickness of metal, 1⅛ in. over all. The inside of the casting must be free from seams or fins and rough places.

The pattern was molded with the flange up and the whole of the pattern in the drag. How the drag was made with the lower half of the pattern in a hole in the foundry floor and the upper portion in the two sections of flasks on hand is shown in Fig. 2.

Stakes were driven into the floor to retain the drag in place, bars of wood were secured to the sides of the drag and extending far enough above the cope to admit of the cope being lifted from the drag and returned to its exact proper and former position; the closing of the cope calls for accuracy, as will be seen later.

The outside of the pattern was made in green sand *B*, Fig. 1, while the inside was made in baked cores. To prevent the sides of the pattern from being forced in by the ramming, a skeleton frame made of common lumber, and so designed that it would resist the heavy pounding of the sand, was put inside the pattern; this was removed after the drag mold was completed.

To use the drying plates on hand to get the core into the oven necessitated making the core in four sections.

Making the core in four sections made three open joints when the four sections were set in place; these must be plastered on all sides in order to make a smooth, sound casting on the inside. It was this that made it necessary to make the mold with a dry-sand core suspended from, and anchored securely to, the cope, as shown in Fig. 1.

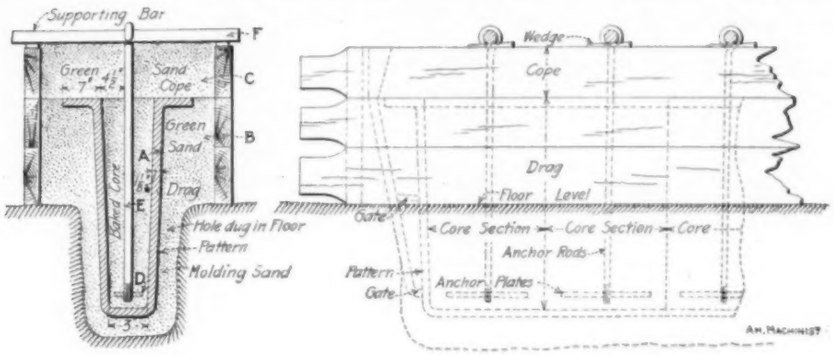
In each section of core was baked a metal anchor plate *D*, with a drilled and tapped hole to receive the anchor rods *E*.

The four sections of the core were suspended from, and anchored securely to, the cope, by means of the cross-supporting bars *F*.

While the pattern was still in the drag, the four sections of the core were lowered into it; these filled the pattern, touching the sides, bottom and ends and flushed with the top of the opening or parting of the mold. Next the cope was placed and filled, the bars *F* placed and secured by means of the wedges shown.

When the mold was completed, a spirit-level test was made across the top of the cope flask; this insured the return of the cope to its exact proper and former position. The mold was now ready. The cope, with the core suspended therefrom, was lifted and raised high enough to permit the molder to work under and around it to do the necessary plastering of the joints and repairs. Next the pattern was withdrawn from the drag, the cope with the core was closed and locked, and the final test made with gates at the bottom and center. The casting weighed 3740 pounds.

Reading, Penn. GEORGE MUNROE.



CLEVER CASTING WITH INADEQUATE FOUNDRY EQUIPMENT

A Chuck for Irregular Work

When manufacturing odd-shaped pieces where a chuck is to be used to hold or chuck the pieces, a special chuck is generally required. The chuck here described is somewhat novel in construction, but the main features are simplicity and durability, and it has remained practically unchanged after turning out many thousand pieces.

It was required to make an indefinite number of pieces, as shown in the cut; these were to be made of brass 1 in. long with a 0.556-in. hole bearing a certain relation to the V-grooves, one piece duplicating the other as nearly as possible. This general outline is made of extruded stock and held within 0.0003 in. The purpose of the chuck is to hold the work while drilling and reaming the 0.556-in. hole in a turret lathe.

The body of the chuck is made of soft tool steel. The inserted piece which forms the stationary V at *A* is hardened. The sides of the hole in the chuck do not touch the work at all, only the V's engage and hold the work. The piece at *B* is spring-tempered tool steel, driven in a close fit at *C*, and is free to spring when a square wrench is applied in the socket of the $\frac{5}{16}$-in. setscrew *G*.

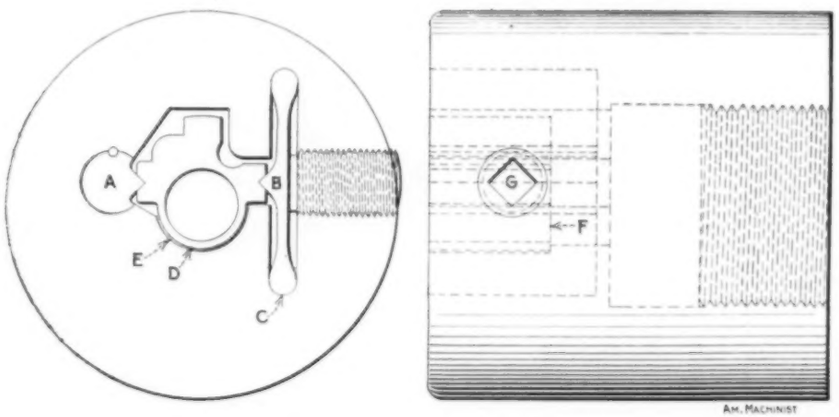
The inserted pieces at *A* and *B* are made slightly longer than 1 in., to insure a full bearing in the V-grooves of the work. The inserted piece *A* is placed in the proper position and the piece *B* at the V is left about 0.01 in. away, in order to permit the work to be inserted easily, and with a slight turn of the wrench held firmly.

It is seen that this chuck in its construction is void of lost motion, and will remain so; it is also easily repaired.

In making the chuck, the shape of the work at *D* is half of a circle, so a round hole is bored the size of the work at *D*, then the rest of the chuck is worked out, allowing the necessary clearance for the work. The work is then inserted and held against the circle. This gives the proper position for placing the pieces *A* and *B*. After *A* and *B* were made, hardened and placed in the body of the chuck, the outline *E* was worked back as clearance. At *F* is a shoulder left at the bottom as a stop for the work, so that each piece will project from the chuck the same amount.

J. W. DICKINSON.

New Britain, Conn.



A CHUCK FOR IRREGULAR WORK

Two Typefounder's Tools

Makers of molds and machines for typecasting are members of an exclusive and little known branch of engineering craft. The molds are works of precision. The actual space to be filled with liquid metal in the mold to form the type body must be absolutely accurate, while the remainder of the mold is made to 0.00025-in. limits. Machines like the monotype or linotype are not here referred to. There is a large quantity of type still produced in casting machines and even in hand molds.

For an instance of the exclusive character of the trade: An order placed in London some time ago for 250 molds was delayed four months, owing to the fact that six of the men were ill, and it was impossible to obtain substitutes for any consideration.

Two small tools constantly in use by this trade are novel and have possibilities of wider application and adoption by other than their present users.

The first, illustrated in Fig. 1, is known as a justifier's square and is used in the same way and for the same purpose as an ordinary machinist's square. The stock is wider and flatter than the ordinary square and the blade is square in section. The tool is hardened, both stock and blade, the two pieces being surfaced all over, after hardening, on a Brown & Sharpe surface grinder. In use it gives a line contact, permitting a ready sighting of the surface to be squared.

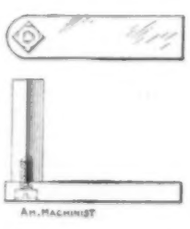


FIG. 1. JUSTIFIER'S SQUARE

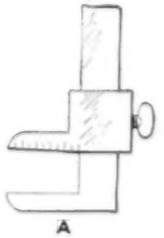


FIG. 2. TURNING FLANGE

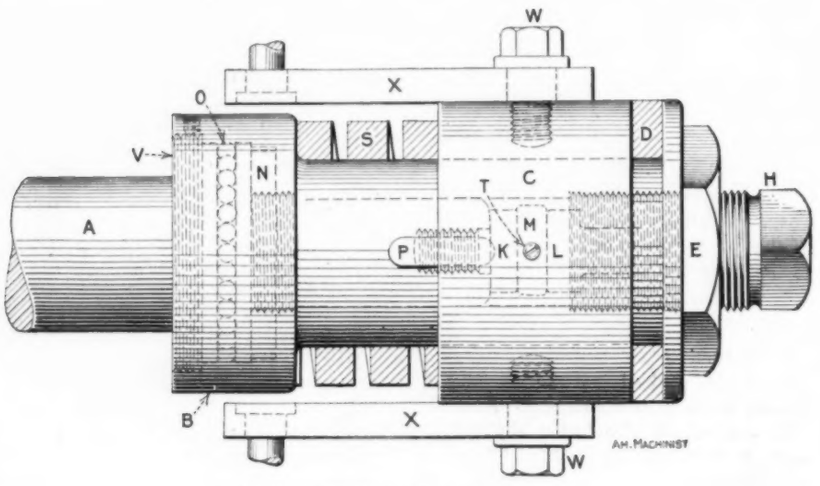
Its construction permits ready access of light both sides of the blade. Inaccuracy of the surface to be squared shows more readily than with a flat contact, however narrow. Compared with the usual form of line-contact square, it has the important advantage that the edge is not easily damaged. Furthermore, when the edge in use is out of truth it is possible to use the other edges successively by turning the blade around.

The other tool, illustrated in Fig. 2, is termed a turning flange, and is used for duplicating sizes. It is an ordinary caliper gage, without divisions along the bar. The fixed pin *A* is square to the bar, the other has an inclination of 0.001 in. in a depth of 1 in. Ten graduations along the sliding jaw give differences of 0.0001 in. The use of the tool for comparison of sizes is evident.

London, England. A. L. HAAS.

A Compression Thrust Bearing

The diagram shows a compression thrust bearing, such as is used on trimming or edging lathes in brass or sheet-metal working plants. The great difficulty with most thrust bearings used on such machines is that no allowance is made for any variation in the thickness of metal, and on this account the action is very hard, often springing the parts of the machine.



A COMPRESSION THRUST BEARING

The design shown obviates this difficulty, as the spring compression is flexible, and should the variation be two or three thicknesses of metal, the spring would still relieve the machine frame or brackets from any abnormal strain.

In the illustration, *A* is the shaft or spindle; this travels from 1200 to 2000 r.p.m., according to the nature of the work. The shaft is turned down and threaded and a nut *H* is screwed against the shoulder, the hardened button *K* is screwed into the reduced end of the shaft *A*. *B* is a sleeve, located in a fixed position relative to the shaft *A*, in which the ball bearing *O* is held between the nut *N*, which is on the shaft, and nut *V*, which is in the sleeve *B*.

The ball bearing takes the pull on the return stroke. The other end of sleeve *B* is tapped to receive the adjusting screw *H*, which carries the other thrust button *L*, which is also hardened. At *M* is a loose hardened button working between *K* and *L*, all three of which are kept flooded with oil by means of a sight-feed oiler at *T*.

The keyway *P* is cut in the sleeve *B* and engages a key fastened to the other sliding sleeve *C*, through which the whole mechanism is operated, through the compression spring *S* by means of the links *X* and the studs *W*. A fiber washer *D* is held in position by the nut *E*.

This mechanism has been thoroughly tested and gives very good satisfaction. The principal thing in making it is to get the three buttons as hard and as smooth as possible.

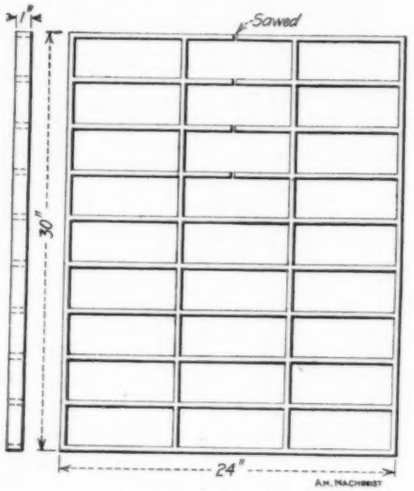
Waterbury, Conn. M. O. DEAN.

Guessing vs. Thinking

I have read with interest Mr. Pray's article in Vol. 35, page 991, and it recalls to my mind a job on which a concern was asked to estimate some time ago. I agree with Mr. Pray that machine work is much easier to estimate than hand work. Knowing the different speeds and feeds is a big advantage over what one man can do on hand work.

A concern had 30 heating grates delivered to it, which were intended for a battery of heating furnaces, but it was found that they could not be lowered into place owing to the inward expansion of the four walls under the action of the heat.

The furnace door was too small and it was suggested that the grates be cut in half lengthwise in preference to ordering new ones. These could then be passed through the furnace door and slipped into place. A near-by machine shop was asked what it would do the job for, and their estimator at once became busy. He found that there were ten walls of cast iron to be cut, each 1x¼ in. thick and decided that the hacksaw was the best method owing to the lightness of the job. The estimator tried a piece of 1x¼-in. iron and cut it in 40 seconds allowing 20 seconds for changing the blade. It was upon this basis that a time of 25 minutes was set. "Why," said the guesser, "that job can be done in 15 minutes." But he was wrong as the estimator proved; the completed job taking 11 hours, or 22 minutes for each grate.



HEATING GRATE

Brooklyn, N. Y. GEORGE MYERS.

Fashions in Tools

There is a tyranny of fashion to which we are all subject in the texture, the cut and color of our garments, and, except for the changes which are made in recognition of the temperature conditions of the successive seasons, there would seem to be little more than an initiative caprice and then the imitative habit to account for them. There are changes of fashion also in our tools, in our ways and means of doing work, and for these it is to be hoped that more rational and satisfactory explanations may be found.—*Compressed Air Magazine.*

During the decade from 1899 to 1909 the average number of wage earners employed in foundries and machine shops increased 24.4 per cent.; the value of the product of these shops increased 53.9 per cent.; according to a bulletin recently issued by the Census Bureau. There were 531,000 wage earners employed in these industries during 1909.

Discussion of Previous Question

Referring to letters and articles previously published

Welding an Engine Frame

F. W. Brady in Vol. 35, page 1135, asked whether a certain crankshaft could be repaired and also gave a typical telephone conversation with two different repair shops. The article was of interest to me because I have done a good deal of such work myself and know what can be done in this line.

FIG. 1. A VERTICAL ENGINE FRAME—BEFORE AND AFTER WELDING

A crankshaft of the dimensions stated in the article is easily welded and will be in perfect alignment; furthermore the weld will be found fully as strong as any other part of the shaft.

The man asking $15 for this job made a very good estimate on the work and apparently knew what he had to do. The other asking $2.50 just to braze the shaft and not guarantee the strength or alignment was evidently not well versed.

I am also very much surprised to note that the owner of the shaft, after investigating the repair shop methods in the city found out that this break could not be mended so as to insure strength, alignment and full size of all the parts. The shaft shown and described on page 1135 can be welded, can keep the original sizes so that it will not even be necessary to rebabbitt the bearings, be in perfect alignment, and the welded portion will be strong enough to guarantee against a break in that place again.

If this shaft broke again it would be more apt to break in another place for the reason that the crystallization due to long service would be annealed out around the repaired place, which consequently can stand a greater shock than any other part.

As an illustration of what an oxyacetylene weld will hold, I might mention an experience with a drum made up of a ⅜-in. boilerplate rolled to a cylinder 20 in. in diameter and butt welded; the two heads were $\frac{5}{16}$ in. thick, dished and flanged, and one welded convex and the other concave. This drum was put under an hydraulic pressure of 1200 lb. per sq.in. or a total pressure of over 188 tons on a 20 in. diameter. Under this pressure, the concave head started to bulge in the center but the weld all around the drum did not show the least leakage or weakness.

Other work in the line of welding is shown by Fig. 1, a broken vertical engine frame.

CHARLES HOLLUP.

Milwaukee, Wis.

The Special Order and Standardization of Machine Tools

No doubt all shopmen look with favor upon the efforts put forth by Mr. Alford, and supported by many prominent machine-tool men toward standardization, and although an ardent supporter of the principle, I cannot help thinking that the more we delve, the greater the mixture we produce.

I have, in a small way, adopted some standards in the shop, the carrying out of which earns for me the title of the "special-order crank" and which entitles me to be exterminated, by having "a prohibitive price put upon my ideas and desires," as suggested in a recent editorial.

If a new engine lathe is required, we insist that the taper for the centers and the screw for the chuck shall be to our specification, and gages, without extro cost. If a new drill press is required the drift slot through the Morse taper must also conform to our standard on the same terms. The maker's own designs may possibly be far superior to ours, and beyond dispute. Ours was adopted as the best possible in our case and may be responsible indirectly for this next order.

I have read the AMERICAN MACHINIST for a dozen years or more, and the more I read the conviction is forced upon me that we have not a standard machine tool. A comparison of the machines advertised today with those of twelve years ago is enough to make this clear.

Many of our so called standard machines have become unrecognizable during this period through repeated improvements. We have been advancing with a regular step. Undoubtedly some of these improvements have been due to the special-order crank, although this is not generally admitted.

During the past ten years I have been closely in touch with grinders. Some four years ago, the grinder was intro-

duced in my present shop. It was a stranger to most in the shop, and although I had operated and supervised this firm's machine in a previous shop, I had a good deal to learn, owing to the many improvements added during the previous two years. I especially admired their improved trip gear.

My admiration, however, vanished completely when a short time later I saw in the advertising columns of this journal a new design in this machine. The whole of the trip gear was removed, a simple addition to the existing handwheel performing all that was required. We now have both types side by side, and when showing visitors around, which shall I refer to as the standard tool, as it was claimed for both that each represented the last word in grinders?

Some day we may require another machine of this type, and accompanying the order will be a specification. As this specification is applicable to most grinders it may be given in full.

We have found your grinders very successful for handling our shafts, especially the ones 1¾ in. in diameter, and from 5 to 7 ft. long. We also admire the convenience of the adjusting screws on the steadyrests, for adjustment purposes. Our operators also admired them as rests for the shafts while fixing the drivers and greasing the shaft centers and also as a rest for the shaft when finished while drying and greasing before returning to the pile.

This we considered was not good for the screws, and we decided to prohibit the practice. We found, on consideration, that some resting place was necessary, both between the rough pile and the machine centers, and between the centers and the finished pile, and for a time very much favored a helper being provided to avoid damaging the screws; but we found the addition of two V-shaped brackets to the outer steadyrests overcame the difficulty entirely.

We are fully convinced that this improvement would be more satisfactory if added to the mold while in the sand, and this order is given conditionally on this being done without extra cost to us, on your quotation; or if you prefer to supply a helper free of charge, we will give the matter due consideration.

We do not desire to place any restrictions upon the further use of this mold and would suggest you call them "The Terry Crank Duplex Double-Acting Compound Grinder Rest," and under no circumstances supply more than two of these rests with each machine, except the very largest ones, when one or two more might be added. Instructions as to their use are not necessary.

Should this specification become a fact I do not anticipate the slightest difficulty in obtaining what I want.

The old maxim: "Find out what your rival wants you to do and then do the opposite" may be applied to the machine-tool business. I know more than one rival firm that would like to see the firm that has supplied our grinders not only refuse the order, but incidentally would like to supply their own design instead, with any alterations we thought necessary.

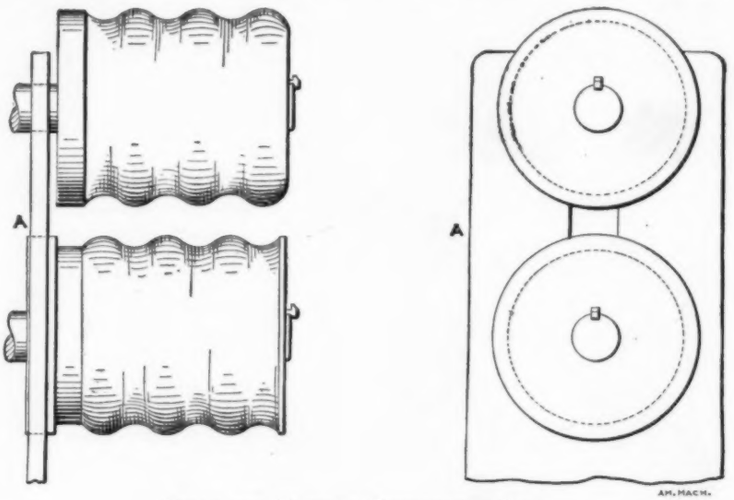
This reasoning may also be applied to the contribution of C. J. Morrison, Vol. 35, page 1174, who recommends firms to allow the special order to go to rivals. This is excellent advice if the rival firm does not desire the order. It it does, stick to it at all costs, as, depend upon it, there is something else beside dollars under consideration.

Belfast, Ireland. F. P. TERRY.

Making Corrugated Cans

A. Whitby's article on corrugated cans, page 309, seems to me to be quite out of the ordinary practice.

The firm I am with turns out thousands of corrugated cans daily, ranging in size from one-half to five gallons capacity. The following method is employed:



ROLLS FOR FORMING CORRUGATED CANS

The blank is formed up on a regular three-roll power machine, then side-seamed on a power seamer and the corrugating is done in the same operation that flanges the ends preparatory to the end-seaming operation. That is, one end is flanged and one-half the body is corrugated at the same time. The can body is then turned end for end and the process is repeated.

The rolls are mild steel, case-hardened, and about 4½ in. in diameter. They are good for any size can that may be freely passed over the lower roll. The width of the flange is regulated by adjusting the gage, *AA*. A new hand will, at first, experience a little difficulty in keeping the stock up to the gage, but it is no trick after a little practice.

The rolls are brought together by a foot treadle, and both hands are free to take care of the work. I have reference, of course, to cylindrical cans only. If there is a better way I am quite sure that I am not the only one who would like to hear of it; not how it ought to be done, but how it is really being done.

Delphos, Ohio. A. J. BREEN.

Applying the Hydraulic Step

In Vol. 35, page 999, under the caption, "New Marine Turbine Reduction Gear," a "hydraulic system for supporting the pinion bearings of a reduction gear" set in connection with a marine turbine was described. This subject is one of peculiar interest to engineers, generally, and especially so in its relation and adaptation to marine turbines.

I am a persistent advocate of the more general use of the hydrostatic step as applied to details of mechanical engineering, having had particular experience in the conservation of that useful and convenient principle in many situations where great pressures under precise control were required.

Heavy rolling and calendering processes, core presses, etc., are gradually becoming subject to the hydrostatic plan, to the entire abandonment of the faulty worms, wormwheels and screws heretofore used.

Using the hydrostatic principle as we do in the larger installments, will gradually lead to the introduction of the same method of producing heavy pressures in the smaller details referred to, and there is no doubt as to which is the best and least expensive to maintain.

Screw threads, whether as screws proper or as worm and wormwheels, are in a way relics of a day gone by, and the more modern hydrostatic method, as a substitute for such things, will be found a valuable acquisition.

Why not require the hydrostatic step for taking the thrust of a wormshaft? The worm and wormwheel as a mechanical motion are valuable expedients for high reduction ratios, and with ball bearings for taking the thrust of the worm, leave nothing to be desired. But why not go farther and substitute "fluid" friction for metallic? Also, why not introduce into the worm and wheel box oil at considerable pressure? With the box slightly strengthened and a suitable oil pres-

sure (from 40 to 100 lb. per sq.in.) metallic friction could be all but eliminated. There is no reason, when having applied the hydrostatic step to the worm thrust, and the heavy pressure has forced lubrication to the worm and wormwheel, why we should not go still farther and apply fluid pressure to the side thrust of the wormwheel itself. That, I think, is a most desirable state of things, the whole of the working surfaces having high-pressure oil interposed.

All spur-gear drives, as far as is practicable (on account of size), all helical, double-helical, and spiral reduction gears, should also have consideration from the same viewpoint, and, if the hydrostatic plan is adopted and adapted the costs for running and repairs will be lessened to a marked degree.

Conviction on the points referred to would undoubtedly come to those who, placed in charge of the repairs of a large factory, were compelled to witness a continual replacement of repairs, such as heavy screws, worms, wheels, etc., "all cut to bits," all worn away by power wasting and preventable friction.

J. T. TOWLSON.

London, England

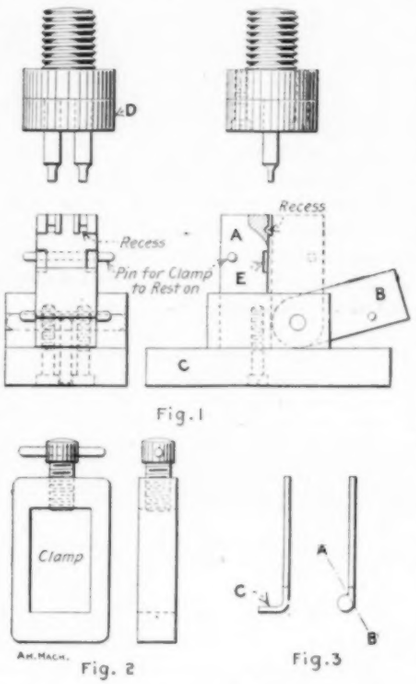
Solid Swaging Hinge Bosses

Referring to Mr. Harris' article in Vol. 35, page 1125, I recently had the same things to make in brass 0.048 inch thick to be swaged on the hinge portion to 0.096 inch thick. I used hard brass and swaged it to as high as 0.120 in. in thickness without a fracture. It was passed at 0.100 inch thick. The variable thicknesses of ordinary sheet brass could be used with good effect. The following describes the tools I used to get the above result:

A piece of tool steel *A*, Fig. 1, was let into the mild-steel bolster *C* a tight fit, screwed and doweled. It was milled away on the face so that the hinge was a good fit all around except at the sides. When finished by the miller, the hinge lay flush with the surface. A small recess was then cut in both sides where the hinge was to be formed. The section shows the slot and recess in one side of *A*. *B* was a piece of tool steel, an easy fit in *C*, and swung on one dowel. *A* and *B* were hardened and tempered.

Two small punches ¼ in. in diameter were fitted into the punch plate *D*. They were filed on the ends a fairly good fit in the slots in *A* and just long enough to reach to the top of the recess in *A;* both were hardened and tempered. A clamp shown in Fig. 2 was made to go over *A* and *B* when close together and pins put in the sides of *A* and *B* to keep the pressure of the screw in the clamp in line with the recess in *A*. It was used as follows:

A little graphite was occasionally brushed in the slots and the hinge slipped in *B* was brought up and the clamp put over both, resting on the pins and tightened. The top of the hinge was then lying flush with the top of *A* and *B*. The punch came down and pressed the metal



SOLID SWAGING HINGE BOSSES

into the recess in *A*. Tney were pulled out, the clamp was taken off and *B* fell away on its hinge. A piece of flat metal was pushed under the hinge at *E* and the hinge came out. The ends of the hinge were annealed.

I experimented in the same way as Mr. Harris, but I found when the metal at *C*, Fig. 4, was swaged down, it got so hard in the process, it passed into the softer metal and practically sheared itself off across *A B*. The boss was on when taken out of the tools but was not strong enough to pass the test. So that way was abandoned. The hinges made this way will stand any amount of rough usage.

Liverpool, Eng. W. H. S.

Accurate Setting of Graduated Circular Scales

In Vol. 36, page 190, in an article on this subject C. S. Cole states:

> It is common knowledge with every good mechanic that it is impossible to set a universal miller table perfectly parallel with the travel so that an end mill will cut just as deep at the tail center as it does at the dividing head.

He goes on to state that this is due to the fact that it is impossible to set the lines of the swiveling saddle and the zero line "into continuity."

Frankly I don't see how any mechanic could set the table *out of parallel* with the travel. Moreover it has very little effect on the parallelism of a piece of work held between centers. If the table were swiveled 10 or 20 deg. either side of the zero line, the only effect would be to mill a surface more or less concaved. What *would* affect the parallelism of a piece of work so held would be the amount a line passing through both centers would be out of parallel with the table travel.

The idea of using fixed angular positions on swiveling members is not feasible or it would have been in use long ago. The reason is this: Any angular surface produced does not depend for its accuracy entirely upon the swiveling member but upon other members which are subject to wear, etc.; therefore, an angular position which is fixed would not remain accurate very long.

Any method for producing very accurate work is distinctly a cut-and-try method, and the graduations are put on for only an approximate setting. In proof of this take the most accurate tool we have, the universal grinder. It is common knowledge among practical mechanics that if a grinder table is adjusted to grind parallel—I am speaking of a cylindrical piece of work between centers—and the tail center is unclamped and moved to a new position for a longer or shorter piece of work, and reclamped ever so carefully, the grinder will not grind *parallel* until readjusted by a cut-and-try method.

Under these conditions a taper pin in the swiveling head would hardly be of much use. The same thing is true when applying the taper pin to a lathe compound-rest; for work held between centers it is just as necessary to have a taper pin in the tailstock on account of the set-over.

Philadelphia, Penn. E. A. ERMOLD.

Drafting Room Efficiency

An article entitle "Efficiency in the Drafting Room," by "Entropy," published in Vol. 36, page 199, attracted my attention.

The statement that drafting-room efficiency has no connection with speed, is, I think, open to some discussion. My conclusions, based on experience, are that drafting-room efficiency cannot be based on hours and minutes. For instance, one man may draw up a mechanism in a certain number of hours by following, in a routine sort of a way, other similar mechanisms previously established. Another man having the same job to do may, by spending some time in thought, develop some new ideas which result in a decided improvement in the mechanism in question. So while the second man may have spent twice the time the first man did, his work would probably be of more value. To cite another case: A draftsman may, by going at top speed, detail a part of a machine in, say, six hours, and make a

costly mistake, while if he had spent a little more time in concentrated thought he would have caught the mistake, although spending approximately eight hours on the job. So in this case also the extra time would be well spent.

Considering speed then, as the time spent in doing a job, we may well say that it has little to do with efficiency. But there is another kind of speed which, I think, has to do with efficiency, and that is the speed of the strictly mechanical movements, i.e., the speed of making lines, of handling the instruments, etc., or, in other words, the rate of speed at which we can express our ideas on paper in the most advantageous and economical way.

There are three fundamental points to consider in making drawings, and they are thought, care and speed; and in every different kind of drawing made, these three fundamentals enter in varying proportions. Concentrated thought and careful attention are always to be considered before mechanical speed. But I believe that there is a certain rate of speed, varying with each kind of drawings, at which a draftsman is at his greatest efficiency.

For instance, a draftsman may turn out a tracing of details in a certain number of hours. Let us say that this tracing looks fairly good. The rate of speed at which this sheet has been turned out may be decreased by, say, 50 per cent., while the looks of the sheet would not be increased over possibly 10 per cent. Again, the rate of speed may be increased by, say, 10 per cent. and the sheet decreased in looks 50 per cent.

While this illustration is rather of a general nature, it brings out the point that I am aiming at, which is, that each individual should determine the rate of speed at which he is most efficient. So, considering drafting-room efficiency as a whole, I think it is more a question of the efficiency of the individuals than the methods or set rules.

I believe we will all agree with "Entropy" that a cranky chief draftsman will often put a man in a state not productive of his best efforts. The ideal chief draftsman from the draftsman's point of view is like the ideal draftsman from the chief draftsman's point of view—a myth.

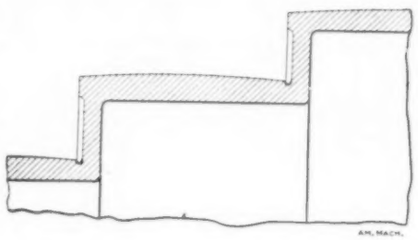
The greatest asset a chief draftsman can have is the ability to develop and instruct his men, not only in things mechanical, but along the lines of general efficiency in the drafting room. This not only makes the draftsman of more value to the firm, but also makes him of more value to himself. It impresses me that the man who is capable of instructing his men along the right lines is far and away ahead of the man with only mechanical ability.

Cleveland, Ohio. JAMES A. PHELPS.

Grooves to Prevent Belt Climbing

The writer has noted with interest the article by F. A. Halsey in Vol. 36, page 211, entitled "Graphical Solution of Cone Pulleys."

We have found that it is not always possible where cone pulleys are used to run the belts slack. This is especially noticed where, as in printing and lithographing machines, the load comes on and off suddenly. When run slack the belt will wave more or less violently. On the downward movement of the belt, air is pocketed in the corner of the cone pulley next to the vertical rise. The edge of the belt on that side rises on the cushion of air thus pocketed.



GROOVES TO PREVENT BELT CLIMBING

When the conditions are just right, the edge of the face of the belt comes in contact with the vertical rise of the cone and, the belt follows up the vertical rise and runs on the next higher step of the cone. The tendency to do this is aggravated because, owing to frequent changes of the belt from one step to another the side of the belt toward the vertical rise of the cone is stretched and thus tends to curl up.

We have found that this trouble is entirely overcome if a little groove is cut in the corner, and below the horizontal face of each step of the cone so that the air may escape. These grooves are plainly shown in the heavy lines in the cut.

New York, N. Y. CHAS. F. CHASE.

Holding Tracings without Pins

In Vol. 35, page 845, J. C. P. Bode describes a method of supporting a small sheet of tracing paper in the center of a large drawing, obviating the uses of drawing pins by using four strips of metal fixed diagonally upon the board with, I presume, drawing pins. The strips are so made as to clip the said tracing at each of its four corners.

While this arrangement may answer the purpose, I think it is somewhat superfluous. Paper weights, as he explains, are, no doubt, in the way and cannot possibly be used on vertical drawing boards. If it is necessary to work close to the bottom edge of the tracing, what allowance is there for a 2½-in. wide-blade T-square, and again, how far is it practicable to work with a set-square sideways?

If, however, his firm is opposed to the use of drawing pins, for which I see no reason, as drawings are for use and not ornament, why not temporarily secure the drawing with adhesive tape (gummed tissue paper in strips 1 in. wide), using a strip about 1½ in. long at each corner and at any other necessary place? The T-square and set-square will then pass over the whole perfectly easy, in fact easier than when drawing pins are used. Such strips being transparent will not deface the drawing, and should they be considered unsightly, may be easily removed by rubbing with a damp cloth.

If an erasure is necessary, press the forefinger and thumb at the opposite sides of the error to prevent the paper pulling from side to side with the pressure of the rubber. I have tried this method innumerable times without injurious effect to a single drawing.

CLARENCE BOLTON.

Accrington, England.

Perpetual Patent Applications —A Correction

In your article on "Perpetual Patent Applications," Vol. 36, page 395, I notice the following statement in connection with the dragging out of applications in the Patent Office:

> The most notable case of this kind is the Selden automobile patent now on appeal to the Supreme Court.

This statement as to its being "on appeal to the Supreme Court" is incorrect. It never was taken to the Supreme Court nor were any steps ever initiated to get it there. The complainants abandoned the entire matter of attempting to enforce this patent almost immediately after the decision by the United States Court of Appeals in January, 1910. So far as I am aware every case pending on that patent has been closed up, bills dismissed, costs taxed and paid. As you are probably aware, I was counsel for all of the defendants in the contested cases and therefore speak with authority.

Detroit, Mich. R. A. PARKER.

A bulletin recently issued by the Census Bureau shows that the printing and publishing industry ranks fifth among the industries of the country, on the basis of the number of employees and sixth upon the basis of the value of the products. The Census showed that during 1909 there were engaged in printing and publishing 258,400 wage earners. During the decade from 1899 to 1909 the number of wage earners in this industry increased by 32.4 per cent., and the value of the products increased 86.7 per cent

A New Electric Welding Process

By B. P. Flory*

The recently perfected Seimund-Wenzel process of electric welding contrasted with other existing methods. Savings in cost and time resulting from its application. It is a process in which the metal is heated at the welding point only, and at a voltage sufficiently low to guarantee the absolute safety of the operator.

*Superintendent of motive power, New York, Ontario & Western Ry. Co., Middletown, N. Y.

A method of electric welding that is quite different in some respects from any other in use at the present time was recently perfected. There are three methods of electric arc welding in use, which are briefly described as follows: 1. When an arc is drawn between the metal to be welded, which forms one terminal of an electric circuit and a carbon electrode which forms the other terminal. 2. When an arc is drawn between two carbon electrodes, the metal to be welded being placed in contact with the arc. 3. When an arc is drawn between the metal to be welded, which forms one terminal of the circuit and a metal electrode which forms the other terminal

The new method which is called the Siemund-Wenzel process comes under the third classification and is briefly described as follows:

The welding clamp which is shown in Fig. 1, consists of the main body and a spring metal blade, both of soft iron. The clamp is wound with a number of turns of insulated copper wire, which being connected to both ends of the clamp, constitutes a branch circuit through which passes a portion of the welding circuit corresponding to the drop in tension between the points of the clamp, and magnetizes the clamp and also the welding wire which is held by it to such a degree that as the molten metal at the end of the welding wire detaches itself, it will follow the lines of force and deposit itself at the point to be welded. It makes no difference in what location the operator has to work, whether it is above him or not, the welding metal will invariably follow the arc.

FIG. 1. THE WELDING CLAMP

The current is obtained from a generator running at from 30 to 60 volts, direct current. This generator has an adjustable rheostat in series with the field, which together with the field is in shunt to the armature. The positive pole of the dynamo is connected to a quieting resistance coil and from this coil to a welding clamp which holds the welding wire.

Swedish-iron wire is used for welding purposes and it has been found by experience that a wire $\frac{5}{16}$ in. in diameter is the best to use. It is also necessary to use a special flux.

This method has been in use at the locomotive shops of the New York, Ontario & Western Ry. Co., at Middletown, N. Y., for the past few months and a large number of interesting welds have been made, some of which follow:

A cast-steel locomotive tender frame which was broken by an accident in three places is shown in Fig. 2. The cost of welding is as follows:

Labor	$8.68
Material	9.60
Total	$18.28
Cost if welded by Thermit:	
Labor	$10.50
Material	82.20
Total	$92.70
Saving by electric welding process	$74.42

The flue sheet had eight cracks in it and was badly bulged at the bottom. In order to hold it in place and also as an experiment the four bottom rows of flues were welded to the sheet. It would have been necessary to apply a new flue sheet to this engine if it had not been welded. The cost was.

Labor	$34.97
Material	1.92
Total	$36.89

Estimated cost of new flue sheet, $120.
Estimated life of new flue sheet, five years.
Additional life given old flue sheet, two years. Value, $48.
Saved by electric welding process, $11.11.

A crack welded in the back of a boiler is shown in Fig. 3. It would have been necessary to put a patch on it if it could not have been welded. The cost was:

Labor	$10.34
Material	0.60
Total	$10.94
Cost of applying patch:	
Labor	$18.00
Material	0.68
Total	$18.68
Saving by electric welding process	$7.74

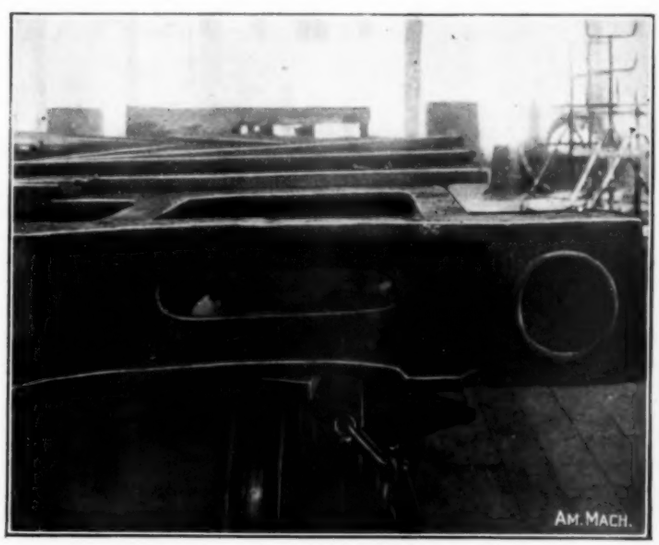


FIG. 2. A CAST-STEEL LOCOMOTIVE FRAME THAT WAS BROKEN IN THREE PLACES

FIG. 3. A CRACK WELDED IN THE BACKHEAD OF A BOILER

Welds were made in a locomotive frame that was broken on both sides of the engine. The costs of both welds were:

Labor	$8.68
Material	3.12
Total	$11.80
Cost if welded by thermit:	
Labor	$12.75
Material	48.45
Total	$56.20
Saving by electric welding process	$44.40

The flue sheet of a locomotive is seen in Fig. 4. This firebox was in such condition that ordinarily it would have been renewed. Three cracks were welded in the door sheet, 12 cracks in the flue sheet, 24 cracks in the left side sheet and 27 cracks in the right side sheet. The cost of the work was:

Labor	$44.80
Material	7.80
Total	$52.60

Cost of new firebox, $1620.
Estimated life of firebox, nine years.
Value per year, $180.
Additional life given old firebox, two years. Value, $360.
Saving by electric welding process, $307.40.

A driving wheel whose tire had been gouged $\frac{3}{16}$ in. in depth on account of the tool getting caught is shown in Fig. 5. It would have been necessary to turn

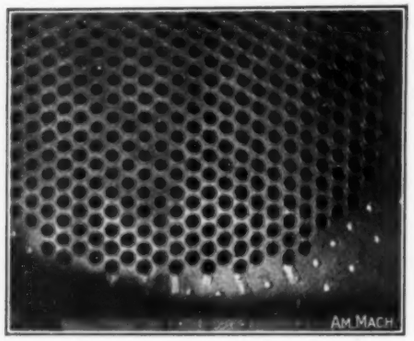


FIG. 4. REPAIRS MADE ON A FLUE SHEET

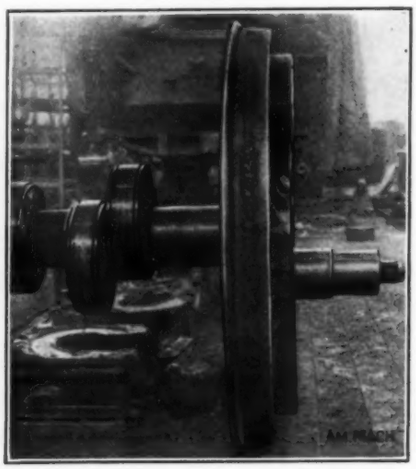


FIG. 5. RETURNING AVOIDED

both tires down if it could not have been welded. The cut was welded as shown in the halftone and the excess metal turned off. No trouble was experienced with adherence of the weld. The cost was:

Labor	$0.62
Material	0.10
Total	$0.72

The value of the metal in both tires which would have been turned was $8.
Saving by electric welding process, $7.28.

Other welds, of which no photographs were taken, have been made. Among them was a locomotive cylinder which had its barrel so badly cracked is several places that it was impossible to keep a bushing in the cylinder on account of its breaking. All of the cracks were welded and the cylinder cleaned up and a new bushing applied. By being able to make this weld successfully the cost of one cylinder was saved.

The savings shown in the operations quoted do not take into account the saving of time in doing the work by electric welding instead of the usual process. It can easily be seen by anyone who is familiar with locomotive work that this is a very large item and in many cases would mean more than the actual saving in money.

There seems to be no difficulty in welding a good quality of cast iron, but if the metal is very porous it is difficult to make a good weld, especially one that would have to stand much strain. The particular advantages of the Seimund-Wenzel electric welding process that we have found are:

1. On account of the small size of the arc and of the small voltage the metal is only heated at the point to be welded and therefore does not set up any strain in the material at other points. 2. As the voltage used is only from 30 to 60 volts there is no danger to the operator. 3. On account of the clamp being magnetized the metal follows the arc, no matter in what position the operator has to make the weld.

[In order to give comparisons their full value it is necessary to understand all the conditions involved. The tender frame referred to was about 1 in. thick by 12 in. deep, not a good section for a Thermit weld. The locomotive frame was 4x4 in., which is a better section. The cost for welding with Thermit is higher than given by other users. The reports of the International Master Blacksmiths' Association for 1908 and 1909, give costs from both the Long Island and the Central Railroad of New Jersey, which range from $12 to $78 per weld for locomotive frames.

There are many places where one method will undoubtedly give better results than any other and other conditions might reverse the results obtained. The success of any system lies largely in its being used in the right way and in the right place.—EDITOR.]

Engineers Honor Founder of Great German Museum

At a special meeting of the American Society of Mechanical Engineers, held in the Engineering Societies' Building, on the evening of Apr. 9, distinguished German visitors in the form of a commission of the famous Museum of Masterpieces of Natural Sciences and Technical Arts, were honored.

Those of our readers who recall the article in Vol. 35, page 300, descriptive of this great museum, will readily understand the action of the American Society of Mechanical Engineers in so honoring the visiting committee, under whose direction the museum is maintained.

Dr. Oscar von Miller, the moving spirit of this great enterprise, delivered an address explaining fully the work of the museum, following which an informal reception to the commission was held.

In the course of his lecture Dr. Miller pointed out that although aëronautics is one of the latest divisions installed in the museum, it occupies some eight or ten rooms. It begins with drawings of crude devices described in ancient writings, reproduces Leonardo da Vinci's plans for his motorless monoplane, the fire balloons of the Montgolfier Brothers, contains the actual gliders used by the first martyr in the cause, Lilienthal, and a succession of later models of air craft of all kinds, with full sized machinery now in use. There are great thaumatropes in which the actual flights of various birds are shown at any speed desired by the student.

The commission will make a tour of the industrial districts of the country in order to study the important achievements of American engineering works.

Of Interest to Exporters

The Bureau of Manufactures now has in press a bulletin in which will be found answers to questions likely to arise in the minds of manufacturers sending out trade literature or opening correspondence with foreign firms. Questions such as: What language is it best to use? In what currency and what weights and measures should prices be quoted? What postage should be placed on the catalog or the letter? Can I prepay a reply from the prospective customer? Is there a parcels post? are consisely answered in the bulletin for each country.

Supplementing these statements are tables for converting the money of foreign countries into that of the United States; also a comparison of prices for countries in which both the monetary unit and the units of weight and measure differ from those used in the United States.

Currency conversion tables and price comparisons are given for over 30 countries. Foreign postage rates and the parcels-post regulations are summarized, and a list is given of the countries in which international reply coupons are valid.

Copies of the bulletin, which is entitled "Factors in Foreign Trade" will be available for distribution at an early date, and those desiring it should make application to the Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C.

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.

505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

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Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.

Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1911, 1,358,200 copies. For March, 1912 (American weekly, American monthly, English weekly and German weekly), total, 91,250.

Of this issue, 22,000.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 153

American Machinist

The Posture of the Workmen

A feature of machine-tool design that is receiving increased attention, is the convenience of operation. Handwheels and levers are being concentrated in a small area, so that they can be reached by the operator without a change of position. On large machines the controlling members are often in duplicate, permitting operation with equal facility from two widely separated points.

This is a commendable trend of design. But associated with it is another feature that recent investigation leads us to believe is being overlooked—the posture of the workman. Not only should the operator have complete control of his machine from a single point, but the posture that he must take to reach the various handles and levers must not be strained. He should be able to stand erect as far as possible; in any event he should not be compelled to stand or sit for long periods in a cramped position, bringing undue pressure upon the organs of the middle third of the body, or with the body so uncertainly balanced as to introduce an additional tendency to slip and fall.

It will be pointed out at once that machine tools are and must be designed for average conditions—for men of average height and reach. But this is not always so carefully done as might be. Many lathes have been designed with the centers moved back from the usual position over the center line of the bed. If this is carried to extremes, the posture of the workman when leaning over to set his tools and watch his cut may be very uncomfortable. We have seen such an instance. Men disliked to run that particular lathe, because they had to reach over too far to see what they were doing.

The principle of design involved is important. It is not merely necessary to have the controlling devices in easy reach form one position, but the posture of the workmen in that position must not be strained.

Full Threads Not Necessary

Although it was clearly demonstrated many years ago, that a nut having a half thread had ample strength to break the bolt on which it was used, we seem to have entirely forgotten this in everyday shop practice.

Tap makers inform us that they repeatedly find cases where the hole drilled for the tap is even less than the root diameter of the thread so that the point of the tap must act as a reamer before a thread can be cut. Needless to say this not only consumes a large amount of unnecessary power, but also adds largely to the percentage of tap breakage.

Every man connected with the production of machinery should fix firmly in his mind the fact that on the thinnest material and with the softest metal generally used, 80 per cent. of the full thread depth is all that is ever required and that in the great majority of machine work, 50 per cent. of thread in the tapped hole is stronger than the bolt or screw which goes into it.

If this be borne in mind and the sizes of tapped holes drilled accordingly, there will be not only a saving in the amount of power and the number of broken taps, but threads will be produced nearer to size and there will be far less spoiled work from taps not starting properly in their holes as well as the cost and annoyance of removing broken taps from a piece of finished work.

We believe this is a much more important subject than it is usually considered and that a little attention to this on the part of machine builders in general will result in a very appreciable saving in machine work.

Tying up Ten Thousand Dollars in Grinding Wheels

One of the advantages of standardizing machine-tool construction, especially in tool-holding devices, is made very clear in the case of grinders of various kinds. The difference in the sizes of grinder arbors is a very serious proposition in a shop with a large number of machines, owing to the necessity for carrying a stock of wheels for all the different sizes.

In one large machine plant, with a great many grinders, it is claimed that the stock of grinding wheels might be largely reduced if all grinders of the same size had similar arbors. The present stock averages about fifteen thousand dollars, and it is estimated that this might easily be reduced to five thousand dollars but for the great variation in grinder-arbor sizes.

Ten thousand dollars tied-up capital might easily prevent the buying of more grinding machines, so that this very fact may act both directly and indirectly against the use of grinders. Directly, by the money not being available; indirectly, by the knowledge that more capital may be needlessly tied up, unless machines of exactly the same make are selected.

Unless machines are used in large quantities, we do not realize the extent to which the lack of uniformity affects the cost of tools and fixtures. But a few instances of this kind will show that standardization of essential features will not only save money to users, but will tend to increase the number of machines used.

The Training of Draftsmen

In this issue we print part of a paper read before the American Society of Engineer Draftsmen on the subject, "The Training of Draftsmen." The greatest number of draftsmen come from the shops, not from the colleges. It is with the training of this larger number that the paper deals.

This is a question in trade education. It is not a problem in technical education. Many young men in the shops wish to enter the drawing room. From their ranks many of our best draftsmen and designers are drawn. The problem is to give them an education which shall fit them for the draftsman's duties. So far as we know, this is something that has not heretofore been discussed in connection with the broad scheme of trade education.

In the paper referred to, Prof. Higbee outlines the subjects which, in his judgment, should be covered by the would-be draftsman. We are glad to see shop work emphasized as one of the important features. He says:

"In whatever way expediency and circumstances may dictate, the boy should be allowed and required to enter some shop or group of shops, where in turn he may learn, by observation and actual practice, pattern making, foundry practice, forging, machine work and machine operation."

With this we heartily agree. Thus the draftsman's training should consist of two elements, shop work and classroom instruction. These are the two elements that enter into trade education. With this clearly recognized, it is but a step to suggest the part-time plan as a feasible method of training draftsmen.

The general advantages of this plan are too well known, and have been too often mentioned in these columns to need discussion again. The thing to emphasize is the need. When this is clearly recognized, we do not doubt but that part-time schools will be established, combining shop work and a course of classroom instruction, to train draftsmen. This will be a natural and much needed widening of the field and scope of industrial education.

Metal Trades Annual Meeting

The papers to be presented at the 14th annual convention of the National Metal Trades Association, to be held at the Hotel Astor, New York, Apr. 11, are announced as follows:

"Prevention of Industrial Accidents," by William H. Doolittle; "Progress in Employers' Liability and Workmen's Compensation," by Miles M. Dawson; "What is the Matter with Business?" by Homer McKeehan; "How Far Must Business Yield to the Demands of Industrial Combinations?" by J. J. Feely.

Of the annual reports of standing committees, it is expected that those of the Systematic Compensation for Industrial Accidents, Henry D. Sharpe, chairman; and Industrial Education, F. A. Geier, chairman, will be especially interesting and timely.

Several speakers of national reputation are announced for the banquet, to be held on the evening of the convention day.

Worcester Machine Tool Merger

The organization of the Reed-Prentice Co., Worcester, Mass., with a capital stock of $2,500,000, brings under the control of one holding company the five following Worcester corporations: Prentice Bros. Co., F. E. Reed Co., Reed Foundry Co., Reed & Curtis Machine Screw Co., and the Crompton Associates.

The new organization is to act simply as a holding company, each of the plants merged retaining its individuality, and doing business separately.

The president of the company is George F. Fuller, of the Wyman & Gordon Co., George Crompton becomes secretary and treasurer, and Albert E. Newton, of the Prentice Bros. Co., will be the general manager. The board of directors consists of the following: Dr. Homer Gage, George F. Fuller, Frank A. Drury, Lucius J. Knowles, Charles M. Thayer, John F. Kyes, Albert E. Newton, Harry V. Prentice, George Crompton, Frederick E. Reed, Vernon F. Prentice and Harry W. Smith.

For the present there will be no general headquarters, and the heads of the companies will be found at their respective places of business.

The officers of the new company are all well known in the machine building field. Mr. Fuller has been active in the management of the Wyman & Gordon Co. for a number of years. His new position will have no effect on his connection with the latter company. A. E. Newton, general manager of the consolidated interests, is secretary and general manager of the Prentice Bros. Co., with which company he has been connected for many years. During his active career he has been president of the Worcester Branch of the National Metal Trades Association for two years and is at present a member of the administrative council. He is also at present treasurer of the National Machine Tool Builders' Association.

A Tap and Die Merger

A holding company, to be known as the Greenfield Tap & Die Co., with a capital of $1,000,000 preferred stock and $1,000,000 common stock, was organized in Boston, Apr. 2. The new company will control the Wiley & Russell Manufacturing Co., and the Wells Brothers Co., both of Greenfield, the two largest manufacturing industries in town.

The merger was formed by Turner, Tucker & Co., of Boston. The officers elected are as follows: F. O. Wells, of Greenfield, president; W. M. Pratt, of Greenfield, vice-president; F. H. Payne, of Boston, treasurer; the above and J. W. Stevens, of Greenfield, A. C. Dutton, of Springfield, J. H. Drury, of Athol, and W. J. Carlin, of Boston, directors.

Charles P. Russell, who is the president and treasurer of the Wiley & Russell Manufacturing Co., established the business many years ago. He is now 72 years old and desires to retire from active business.

Personals

W. F. West, formerly with the Fiat Automobile Co., Poughkeepsie, N. Y., has been appointed superintendent of plant 2 of the Oakland Motor Car Co., Pontiac, Mich.

George T. Gwilliam, who has been New York resident engineer for the Hess-Bright Co., has organized the Gwilliam Co., New York City, of which he is president.

Simon MacKay, until recently general superintendent of the Union Twist Drill Co., Athol, Mass., has accepted a position as works manager of the L. S. Starrett Co., Athol, Mass.

William E. Mansfield, until recently assistant chemist of the Halcomb Steel Co., Syracuse, N. Y., has accepted a position as chemist of the Page-Storms Drop Forge Co., Chicopee, Mass.

Archibald N. Goddard has been appointed general superintendent of the Union Twist Drill Co., Athol, Mass. Mr. Goddard was formerly superintendent of Morgan Construction Co., Worcester, Mass.

E. E. Barney, at present superintendent of the Smith Premier Typewriter Works, Syracuse, N. Y., has been appointed to succeed John Calder as manager of the Remington Typrewriter Works.

F. L. Neely, who has been connected with the construction, testing and sales departments of the Allis-Chalmers Co., has accepted a position as mechanical engineer with the Central Georgia Power Co., Macon, Ga.

Adison H. Riggs, whose nut-tapping machine was described in our columns in 1902, is requested to communicate with us for the purpose of furnishing information in connection with the machine mentioned.

Gardner Cornett, vice-president and manager of the New York office of the American Steam Gage & Valve Manufacturing Co., Boston, Mass., recently sailed for an extended European trip in his company's interests.

H. A. Smith, for the past eight years manager of the machinery department of the Syracuse Supply Co., Syracuse, N. Y., recently resigned in order to organize the H. A. Smith Machinery Co., Syracuse, N. Y., of which he is president.

John Calder, for a number of years manager of the Remington Typewriter Works, Ilion, N. Y., has resigned his position in order to become associated with the Cadillac Motor Car Co., Detroit, Mich. Mr. Calder's resignation takes effect on May 15.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

An Internal Grinder

The halftones show front and rear views of an internal grinder known as the "No. 22 Internal Grinding Machine" built by the Brown & Sharpe Manufacturing Co. Providence, R. I.

This machine is designed to meet the requirements of all varieties of internal grinding work that can be revolved. Holes from 2½ to 12 in. diameter and 8 in. deep can be ground, and the machine will swing 18 in. With a special spindle, holes less than 2½ in. in diameter, not exceeding 12 in. deep, can be ground.

A heavy bridge of metal is bolted to the right-hand end of the machine bed, and upon this the grinding-wheel stand and slide are situated. The grinding-wheel spindle is driven by a web belt from an intermediate shaft at the back of the wheel stand and this shaft in turn are belted to the overhead works.

Separate Speeds and Feeds

In this machine, as in the universal and plain grinding machines built by this firm, the work speeds and table feeds are completely separated. By this arrangement it is possible to obtain a correct table feed for any work speed. Thus, when it is desired to remove stock rapidly, a slow speed and fast feed are available. Both work and table feeds are started and stopped by a single lever located on the front of the machine.

All wearing surfaces throughout the machine are adequately protected from grit; the ways of the bed are always covered and the oil holes are protected from grit and dust. All screws, bolts, and nuts requiring frequent adjustment are hardened. The handwheels and levers for controlling the various movements of the machine are all placed at the front.

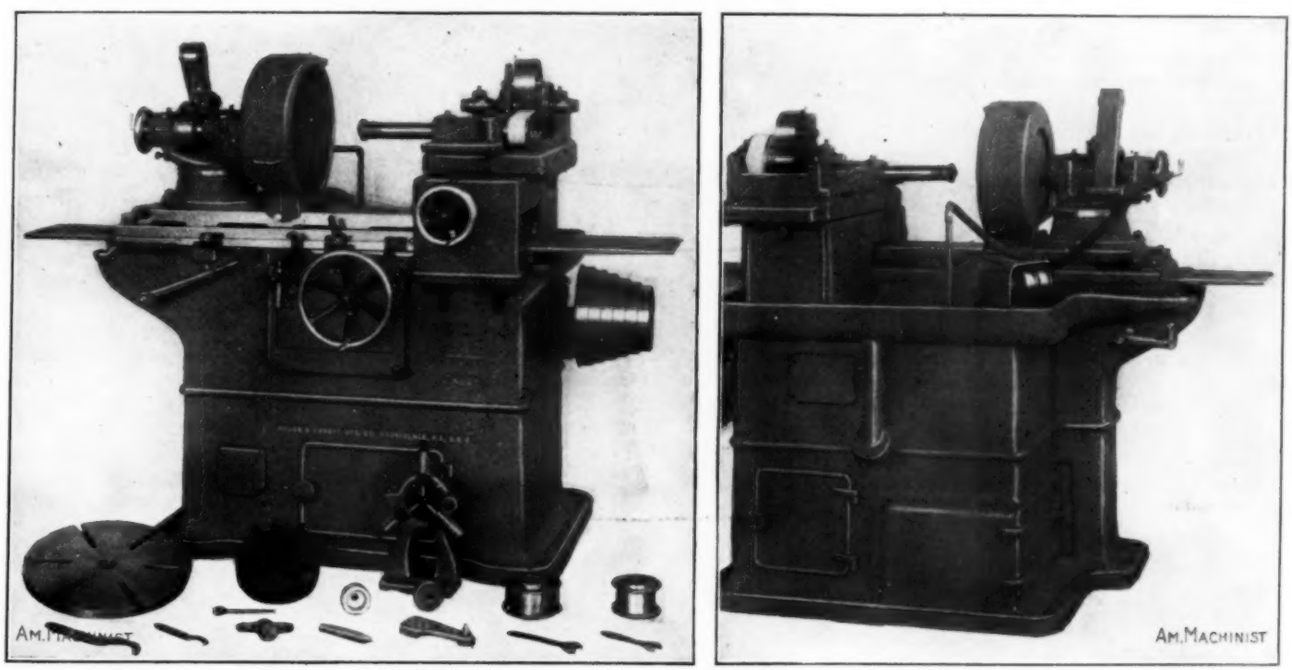
The wheel spindle is of hardened tool steel and is inclosed in a heavy sleeve that extends practically its full length. Together, the spindle and sleeve form an integral part which can be easily and quickly removed and another spindle and sleeve of smaller size put in.

At the front end of the spindle, and close up to the wheel there is a phosphor-bronze box in the sleeve, and at the pulley end an annular ball bearing is provided to take the pull of the belt and reduce friction to a minimum. The different grinding wheels used are mounted on a sleeve having a tapered hole that fits the end of the spindle.

An ample range of independent spindle speeds is obtained by the use of interchangeable split pulleys on the intermediate shaft at the back of the wheel stand. An idler pulley is provided to keep an even tension on the belt and take up the slack due to the use of pulleys of different diameters. Three split pulleys are furnished, providing for speeds from 3990 to 7300 r.p.m.

The wheel stand swivels, thus permitting the spindle to be set at an angle when grinding the face of cutters or automobile gears. This feature is also convenient when a hole has been ground and it is desired to grind the face of the work before removing it from the machine.

A transverse movement of the slide is



Front and Rear View of Brown & Sharpe Internal Grinder

The machine is particularly adapted to grinding holes in hardened steel gears, cutters, collets, bushings, etc. Taper holes can also be ground easily and accurately, and work such as the facing of recesses in automobile gears can be done without removing the piece from the machine.

The work to be ground is fastened, either in a chuck or on a faceplate mounted upon the work spindle which is driven from the overhead works. The headstock carrying the work spindle is fastened to the table of the machine, which has an automatic reversing longitudinal movement similar to that of universal and plain grinders.

obtained through a worm and wheel actuated by the handwheel at the front of the machine. When it is desired, an automatic cross-feeding mechanism similar to that found on all Brown & Sharpe universal and plain grinders, can be furnished on this machine.

THE HEADSTOCK

The headstock is fastened to the swivel table by means of bolts that slide in a T-slot. It swivels and can be set at any required angle, the amount of adjustment being indicated on the graduated dial on the base. The spindle is hollow and runs in bronze boxes provided with means of compensation for wear. It can be locked in position when removing the faceplate, chuck, or an attachment.

The belt-tightening device shown over the pulley consists of a small pulley mounted on a bracket that can be drawn forward or pushed back by means of a handle. When drawn forward, a tension is brought upon the belt, causing the spindle to revolve and drive the work, and when pushed back the spindle may be quickly brought to a stop for changing the work or it can be revolved by hand when centering a piece. A range of 12 work speeds, varying from 40 to 340 r.p.m. is provided.

The travel of the table is automatic and entirely independent of the speeds of the work and wheel. It is controlled by adjustable dogs on the front of the table that operate against the reversing lever. The dogs can be raised and the table run beyond the reversing points without disturbing their adjustment. When the work is finished, the trip dog nearest the wheel is raised, the table then moves to the left until the power feed automatically disengages. It may then be moved farther away by the large handwheel. After a new piece of work is put in, the table is moved up by means of the handwheel until the work nearly reaches the wheel, when the power feed automatically engages.

PROVISION FOR WET GRINDING

The soda water for wet grinding is pumped from a tank located in the bed and is fed to the wheel through the hollow work spindle.

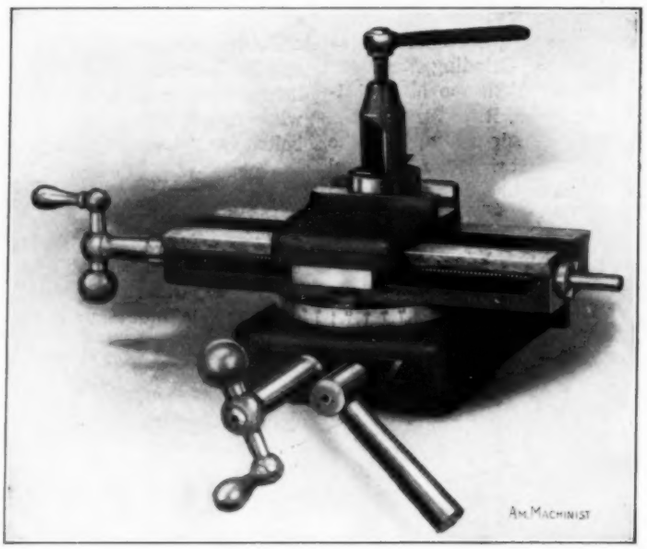
In other details the construction of this machine differs but little from that of their company's universal grinders. The swivel table, however, pivots on a stud located beneath the headstock making a long leverage from that point to the end, thus enabling very fine adjustments to be made in setting to grind straight, or in bringing a taper to the exact angle after the headstock has been set as closely as possible by the graduations on its base.

There are six changes of table feed varying from 15 to 48 in. per minute available for any work speed. The equipment furnished with the machine is shown about the base in the front view, and also includes overhead works.

Improved Slide Rest

The halftone illustrates an improved slide rest recently developed by the J. G. Blount Co., Everett, Mass., for use in connection with their 11-in. swing lathes. This rest is so designed that both the cross and lateral feed-screws are not exposed to chips and dirt.

The handle for the lateral feed-screw is detachable and may be used at either end. The graduated swivel is between the upper and lower slides and is held in position by two T-bolts, which is the same method as is used on engine-lathe carriages. The rest is held rigidly to the lathe bed by an eccentric clamping device. It has a lateral feed of 7½ in. and a cross feed of 5½ in., and takes tools $\frac{7}{8}$x¾ in. It will swing a piece of work 7½ in. in diameter over the rest.

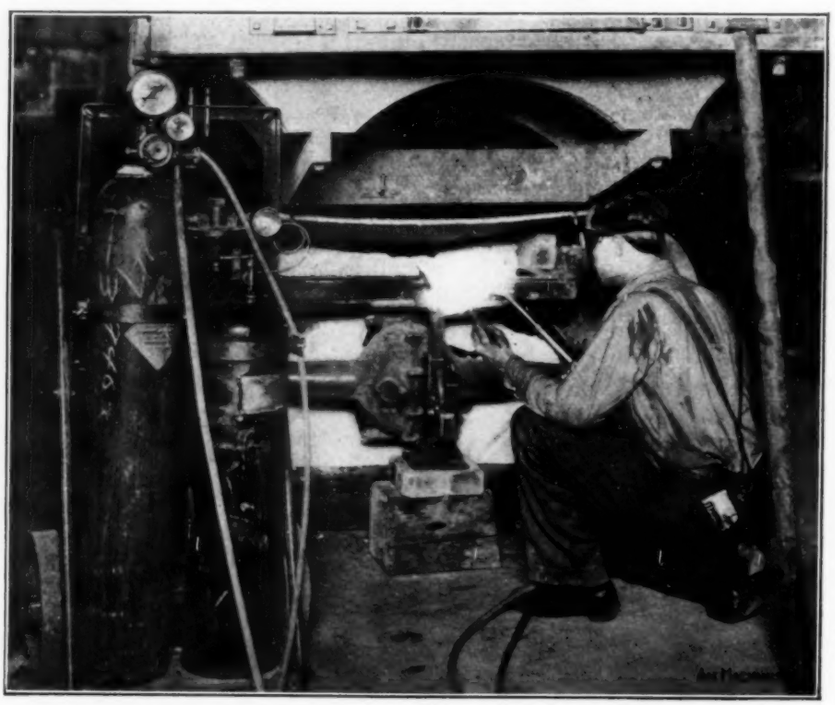


BLOUNT SLIDE REST

Portable Oxyacetylene Welding Outfit

The oxyacetylene welding outfit shown in the halftone was recently placed on the market by the Russel M. Seeds Co., Indianapolis, Ind., under the name of "Presto-O-Welder."

The apparatus is of the more or less usual design and requires little explanation. As will be noted it is compactly arranged and mounted on a steel truck.

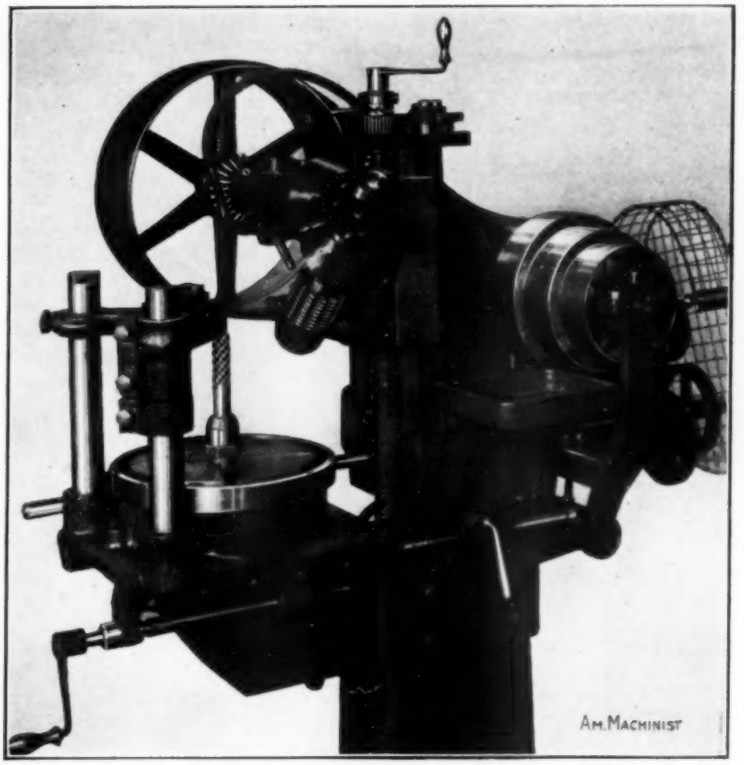


PORTABLE OXYACETYLENE WELDING OUTFIT

Special Spiral Gear Hobber

The gear hobber shown herewith is a special type designed to hob spiral gears of a certain angle.

Such a machine cannot be adjusted to cut angles differing more than 8 deg.



SPECIAL FARWELL SPIRAL GEAR HOBBER

It is a recent design of the Adams Co., Dubuque, Iowa, for such special work as makes unnecessary the universal features of its regular gear hobber.

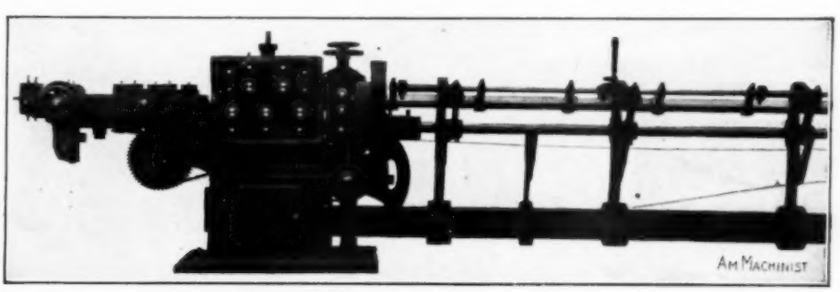
A Geared Roll Straightener and Cutting Machine

The halftone shows a geared roll straightening and cutting machine, capable of handling flats 1¼ in. wide by ¼ in. thick, and also capable of handling ¾-in. squares or hexagons, straightening and cutting to accurate lengths. It was arranged to cut extreme lengths of 20 ft., but only a section of the extension is shown.

The machine is driven by a balance wheel, which connects with a train of gears operating the horizontal and vertical straightening and feed rolls. There are five vertical and five horizontal rolls, all geared and grooved for the shape of the material they are to handle. The upper horizontal rolls and the rear vertical rolls are adjusted, by means of the set-screws to suit the size of material being handled. The feed rolls are adjusted by means of the handwheel shown above them, and driven in unison with the back-feed rolls by means of the chain and sprocket.

The extension consists of a guide bar with a suitable groove for the shape of the material being handled, and a cover, or apron. In this groove is an adjustable stop gage, which is set for the length to be cut. It is also provided with suitable brackets for catching the cut material as it falls out of the guide bar, and the whole is supported by heavy floor brackets.

The machine is a recent product of the F. B. Shuster Co., New Haven, Conn.



GEARED ROLL STRAIGHTENER AND CUTTER

Safety Bottle-Holder

The little device shown herewith has been designed and placed on the market by the Western Engineering Co., 326 W. Madison Street, Chicago, Ill., to prevent the familiar office and drafting-room ink bottle "tradegy."

SAFETY BOTTLE HOLDER

It is handy and devoid of frills.

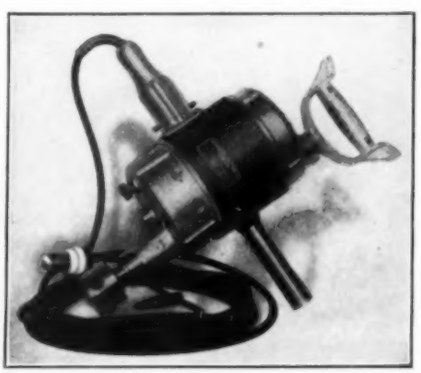
A New Portable Electric Drilling Machine

The portable electric drilling machine shown in the halftone has been recently developed by the American Electric Tool Co., West Newton, Mass.

It has a capacity of ½ in. in steel, weighs 23 lb. and has 2 speed changes, 350 and 650 r.p.m.

The armature of the motor runs in ball bearings. The gears are of hardened steel and Parsons bronze; and by means of a thumb-nut on the front head the speeds are changed while in operation.

The motor is air cooled and instant control is obtained by a quick-break switch in one of the side handles.



PORTABLE ELECTRIC DRILLING MACHINE

An Interesting Milling Jig

By Christian F. Meyer

The jig described in this article is designed to cut the slots *A*, *B* and *C* in the cam, Fig. 1. As shown, the cam consists of two halves *D* and *E*, which are fastened together on the same flange

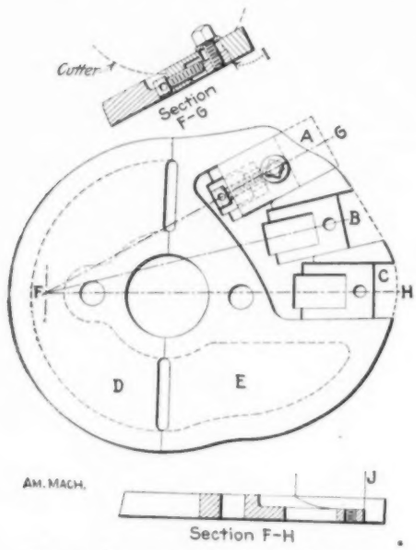


Fig. 1. Cam to be Slotted, Showing Position of Adjusting Slides

but only the part *E* will be considered here. The three slots are to receive adjustable strips, one of which is shown at *A*, used to either change the outline of the cam or take up the wear at the points of hardest service.

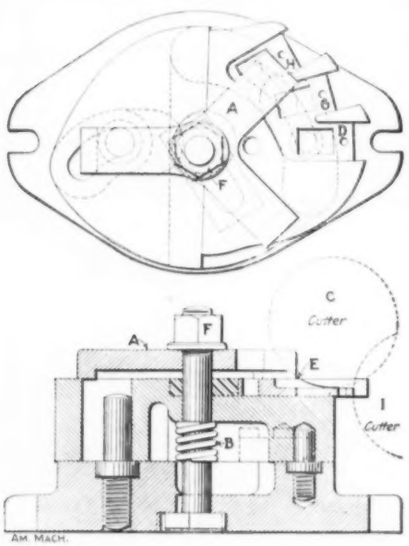


Fig. 3. Assembled Fixture with Cam in Place

Fitting the Cam Together

The two parts of the cam are first fitted together, the center hole bored and the small holes drilled, after which the three slots are milled. A little inspection will show that this is not as easy as might be imagined. Although the center lines of all three slots run to one point *F*, it must be considered that the distance from this point to the end of the various slots is entirely different, and also that the shoulder *I* on the slide must fit against the shoulder *J* of each slot and lie snug against the curve *K*, where the cutter runs out, all slides being exactly the same size.

If these slots were cut in the regular way it would be necessary to reset the

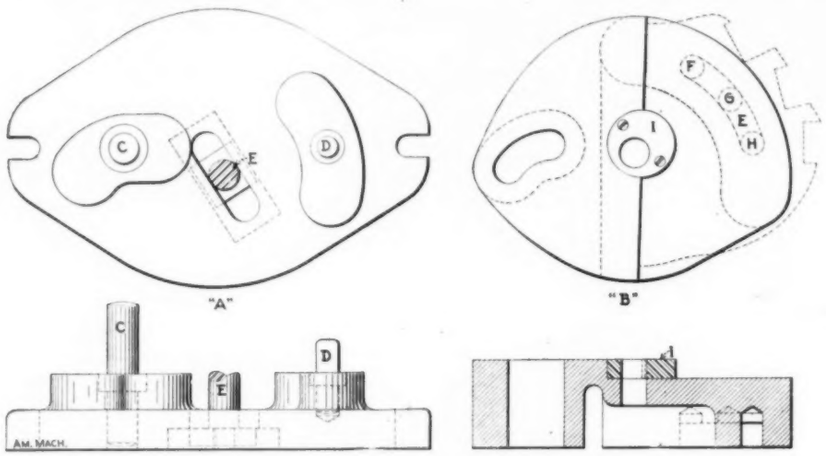


Fig. 2. Top and Bottom Parts of Cam-slotting Fixture

automatic stops of the miller for every slot, or else to feed by hand, either of which would be inconvenient and expensive on work of this kind in quantities, so the jig described was made for the purpose. This jig consists of a base *A*, Fig. 2, and a top part *B*, both of cast iron, two studs and a bolt being set into the base at *C*, *D* and *E* respectively, the bolt being made to slide in the slot into which it is set, as shown.

The top part *B* is slotted partly through underneath at *E* and three indexing holes *F*, *G* and *H* are drilled through for the stud *D*, the slot which is cut partly through, being to guide the stud to the next hole when indexing. A steel disk *I*, the same size as the bore of the cam, is used to locate the part of the cam to be slotted, the position of which is indicated by the dotted lines, the two parts of the jig with cam in place being shown in Fig. 3, a clamp *A* holding the cam down and a heavy spring being placed at *B* in order to counterbalance the weight of the top part, when indexing.

Two Table Settings Neccessary

In using this jig, two settings of the table are necesary, the first setting bringing the cutter to the height shown at *C*. The cut is started and the slot *D* is milled, the automatic stop being set so as to cut to *E*, then the jig is indexed by loosening the nut *F* and turning so that the stud-pin will enter the next hole. This brings the cam into position for milling the second slot *G*. The peculiar action of the top plate, caused by the way it is moved by the studs and bolt in their respective slots, brings this slot into exactly the same position as was the first one. This slot milled, the third one *H* is milled and then the table is raised so as to bring the cutter into the position shown at *I*, and the outer ends of the slots milled to the correct length, the indexing being done as before. Fig. 4 shows the second and third positions of the jig in connection with which no further explanation is necessary.

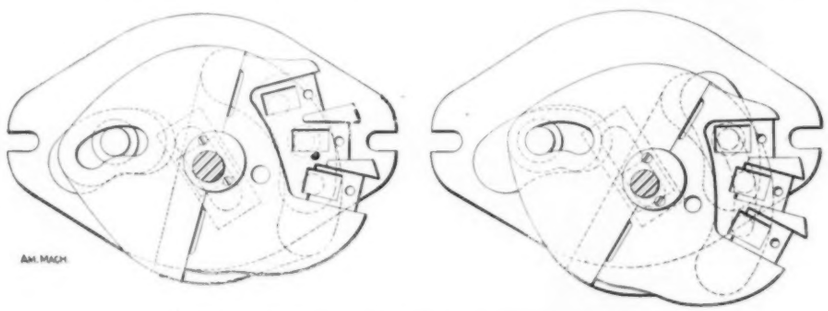


Fig. 4. Second and Third Positions of Jig.

It is pointed out in connection with oil that 10 large Atlantic liners, each burning 40 tons per hour on 15 round trips a year of 120 hours each way, would require 3 per cent. of the world's present output.

Fitting Up a Heavy Jaw Clutch

By G. E. Thompson

In building a heavy clutch-operated machine where the work was very severe and the clutch had to be operated possibly eight times a minute throughout the working day, a jaw clutch was adopted.

The moving part of the clutch was about 27 in. in diameter and weighed 1500 lb. The design did not present any particular difficulty except that of moving so much weight quickly and the necessity of power operation in both directions.

When the machine shop started to machine the clutch jaws, we found that we had no way to do this accurately. Finally we mounted the revolving table of a vertical miller on a planer, fastened one-half of the clutch on top of the table and braced up the tottering structure with wooden wedges between the clutch and an angle plate bolted to the planer platen.

In this way we could use the up-and-down feed of the planer and turn the revolving table by hand to set for the depth of cut, the planer tool being set to plane to the center of the clutch.

The planing was done to a careful layout but the greatest error was slightly over $^1/_{64}$ in. The fitters filed what they thought were the high jaws and the machine was assembled and tested.

After working the clutch five or six times, the jaw faces seized and began to cut. The troubles of the draftsman began at the same time. After going over the calculations for pressure on the clutch it was apparent that the clutch must be fitted so as to get at least one-third of the full bearing on every jaw in whatever space it happened to engage. The effort of the shop funny man, who chalked "scrap it" in big letters on the side of the machine, did not help. Though the fitters frankly admitted that they had no way of working except cut and try, the draftsman let out a link or two in his think box and suggested a plan.

After the usual pleasant preliminaries which are apt to follow a draftsman's attempt to "interfere" in the shop, permission was obtained to boss the fitting of the clutch himself.

This particular clutch had five jaws and one half was marked with a figure for each jaw, the other half with a letter. A cast-iron plug, turned to fit the bore of the clutch halves and keep them central, completed the mechanical equipment. A piece of paper with a checker-board diagram, as shown, formed the bookkeeping department.

One half of the clutch was laid flat on the floor with the plug in the base. The other half was painted with red lead on the jaw faces and entered in the lower half, so that faces 1 and A, 2 and B, etc., matched.

By taking the weight of the upper part on the crane we found one could easily mark the jaws that came in contact.

For example, let us suppose that at the first trial jaws 1 and A showed contact; 2 and *B*, 3 and *C*, did not, but 4 and *D*, 5 and *E* showed a bearing. The record was kept by an *x* for contact or an 0 for no contact at the junction of the columns in the diagram for each jaw. The record of fits for that position forms a diagonal line, as indicated by the small figures on the table. This was repeated five times, turning the clutch one jaw at each trial.

Inspecting the table, we see that jaws 1 and *E* hit in every position, so we assumed that these were high and filed them off a few thousandths. Jaws 2, 4, *C* and *D* hit in three positions, and were filed slightly. Three repetitions of this process gave us some bearing on each jaw in every position and a slight filing with a fine file was considered good enough.

	A	B	C	D	E
1	x^1	x^2	x^3	x^4	x^5
2	0^5	0^1	x^2	x^3	x^4
3	x^4	0^5	0^1	0^2	x^3
4	0^3	x^4	0^5	x^1	x^2
5	0^2	0^3	x^4	0^5	x^1

TABLE SHOWING CONTACT OF JAWS

The machine was shipped without further trial and now has been running two years without any trouble at the clutch.

The "after it's finished engineers," of whom this shop has a large and efficiently organized force, still say that the additional fitting was not necessary. Their contention is that the clutch in running would tend to correct the inaccuracy of the fitting.

Can any of the American Machinist's readers give the benefit of their experience along this line?

The draftsman is still wondering if in this case it would have been more professional to have kept out of the shop and say "I told you so" when the machine went wrong, laying the blame on the fitters, or to get a little dirt on his clothes and boss the job to suit himself, as was done.

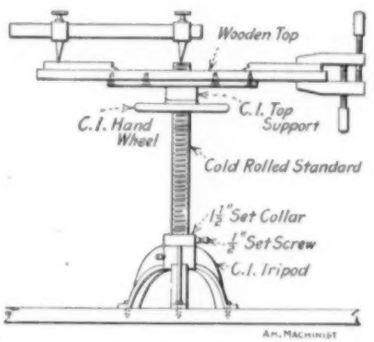
A construction of law in Kentucky by the Court of Appeals is of interest to machinery builders. The decision of the lower court was upheld. A woman hired an automobile, having a rumble or small rear seat fastened to a tool box. This box and seat became loosened, fell off and the woman was injured. She recovered heavy damages from the automobile maker. Thus the machinery manufacturer is made liable to a third party when the article is dangerous to life and limb, and contains defects concealed from the purchaser and user.

Pattern Makers' Adjustable Table

By Leroy M. Collins

The illustration shows a pattern maker's adjustable table, simple, but durable in construction.

The top is round making it convenient for the workman, as the center is equally accessible from all sides. It also facilitates clamping material upon the board. The clamps may be used here and there around the board with no interference. The use of the beam compass also becomes a pleasure when you know that the center is always correct and that the adjustment is such that the center point may be brought level with any circle that is to be found.



A Substantial Pattern Makers' Adjustable Table

The makeup of this table consists of a cast-iron tripod 6 or 8 in. high; its hub is bored 1½ inches and on one side is tapped for a ⅜-in. setscrew. This is to hold the standard firmly in place.

The standard is a cold-rolled shaft 1½ in. in diameter and about 36 in. long and threaded with ¼ in. single-pitch threads running nearly its entire length. On this shaft or standard is placed next to the tripod a 1½ in. set-collar to aid in the adjustment at the bottom.

The spider or top support is made of cast iron having six arms of suitable length. In its hub are cut threads to fit the standard. Below this top support is a handwheel with a threaded hub.

By turning the top of the table to right or left it passes up or down the shaft as desired. When the right height is attained the handwheel is spun around the shaft until it comes in contact with the hub of the spider. This acts the same as a lock-nut, thus holding the top from turning.

The top is of wood, 36 in. in diameter and 1¼ in. thick. In its center is a 1½-in. hole which lets the shaft pass up or down. It is fastened to the spider by wood screws. These screws are inserted from the under side, thus leaving the top or surface of the table unobstructed for use.

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

METAL WORKING

NEW ENGLAND

The spring shop, connected with the Boston & Maine R.R. repair shop, at Keene, N. H., was destroyed by fire, Mar. 30. Loss, $5000.

The General Electric Co., Schenectady, N. Y., is considering the erection of a large lamp factory, at Boston, Mass.

The contract has been awarded for constructing additions to the factory of the Macallen Co., South Boston, Mass., manufacturers of electrical specialties. Noted Apr. 4.

Plans have been drawn for the erection of a municipal garage for Boston, Mass., at Albany St. yards of the Department of Public Works. The plans provide for a concrete structure large enough to accommodate about 50 cars. Estimated cost, $55,000. Louis K. Rourke is commissioner.

The G. H. Gilbert Manufacturing Co., Gilbertville, Mass., contemplates the erection of a large brick boiler plant.

The ring factory of William H. Ford, Lowell, Mass., has been enlarged and will increase its output.

The contract has been awarded for an addition to the plant of the Millers Falls Co., manufacturers of hardware, Millers Falls, Mass. It will be of brick, 60x200 ft., two stories high. E. C. & G. C. Gardner, Springfield, Mass., are the architects. Noted Mar. 14.

A. J. Mottlay, Pittsfield, Mass., plans to take over the plant of the Jacobson-Brandow Co., on Columbus Ave., and equip it for the manufacture of the autophoto machine he recently patented. About $100,000 will be expended.

Joseph G. Roy has been awarded the contract for the addition to the factory of the Moore Drop Forge Co., on Birnie Ave., Springfield, Mass. It will be a two-story brick building, 45x132 ft. H. L. Sprague is the architect. Noted Feb. 28.

The Reed-Prentice Co., Worcester, Mass., has been organized, with $2,500,000 capital, to manufacture machine tools or their parts. The firms forming the consolidation are the S. E. Reed Co., Prentice Bros. Co., Reed Foundry Co., Reed & Curtis Machine Screw Co. and the Crompton Associates.

The Rhode Island Fitting Co., Providence, R. I., recently incorporated, will erect a machine shop and pipe-fitting factory. John H. Dickinson, Providence, is one of the incorporators.

Bids are being received by F. Alton Clark, architect, Naugatuck, for the construction of a factory, in Derby, Conn., for the Dairy Machinery & Construction Co. It will be two stories high, 50x180 ft.

The Hart & Hegeman Manufacturing Co., manufacturer of electrical supplies, Hartford, Conn., will build an addition, 60x200 ft., to its factory, on Capitol Ave. The plans provide for raising the present three-story building an additional story.

The Prentice Co., New Britain, Conn., recently incorporated, with $100,000 capital, has leased a factory, in Berlin, Conn. The company will engage in the manufacture of small metal goods.

The contract for the erection of new buildings at the plant of the New London Ship & Engine Co., New London, Conn., has been awarded. The north end of the plant will be enlarged by a building 108x130 ft., while a similar addition, 108x103 ft., will be built on the south end. Each addition will be two stories high, of brick and steel.

Plans have been completed by Frank Elwood Brown, architect, for the erection of a garage and storehouse at the plant of the New Haven Dairy Co., on Hazel St., New Haven, Conn. The building will be one story, 25x70 ft., of brick

Plans have been prepared for a new factory to be erected at the corner of Robbins St. and Grandview Ave., Waterbury, Conn., for the French Manufacturing Co., makers of brass and copper tubing. It will be 40x80 ft., one story high, and 40x100 ft., two stories high, of brick, with steel columns, girders and trusses. The present factory will be torn down and the new building erected on the site.

The Waterbury Buckle Co., Waterbury, Conn., will build a large addition to its plant.

The Bristol Co., Waterbury, Conn., manufacturer of steel fishing rods, will build an addition to its plant.

The Risdon Tool & Machine Co. will move its factory from Waterbury, Conn., to Naugatuck, Conn. The Board of Directors has been authorized to secure a site for a factory building. Charles E. Beardsley, Waterbury, is president.

MIDDLE ATLANTIC STATES

Plans have been completed for the erection of a machine shop, 30x60 ft., for the Modern Machine & Tool Co., at 940 Broadway, Albany, N. Y.

The Bradley Ax Co., formerly located at Waterbury, Conn., will build a large factory, at Richard and Bowen Sts., Brooklyn, N. Y.

The Ontario Knife Co., Franklinville, N. Y., has awarded the contract for an addition to its plant. It will contain about 35,000 sq.ft. and will be built of steel, wire-glass and vitrified brick.

Plans are being prepared by the Niagara Merchandising Co., Lockport, N. Y., for a three-story factory building, to be erected on Charles St., for the manufacture of laundry machinery.

Bids were received, Mar. 22, by the Public Service Commission, New York, N. Y., for constructing Section 2A, Route 5, of the Lexington Ave. Subway, Tri-Borough Subway System. The contract has been awarded to the O'Rourke Engineering Construction Co., 345 Fifth Ave., New York, at $912,352.

The top floor of the three-story automobile factory, occupied by M. F. Marlborough, at 427 Clermont Ave., New York, was damaged by fire, Apr. 2. Loss, $7500.

Contracts have been awarded for a group of buildings to be erected at Van Ness, N. Y., for the New York, New Haven & Hartford R.R. Co. A car barn and repair shop, 150x371 ft., one story high, a four-track inspection building, 80x378 ft., one story high, a lye-vat building, storehouse, and power house are included. All will be of brick and steel, with concrete foundations.

J. F. Taylor, Atlantic City, N. J., contemplates the erection of a large garage, to cost between $60,000 and $75,000.

The Pittsburgh Steel Foundry Co. is preparing plans for a new core room and additional equipment, at Glassport, Penn.

The Sheeler-Hemsher Co., 811 Fairmont Ave., Philadelphia, Penn., will soon let the contract for the erection of a two-story addition to its brass foundry.

Plans are being prepared by Penchert & Wunder, architects, 310 Chestnut St., for the erection of a factory for Berko Bros., wire works, 327 North Randolph St., Philadelphia, Penn. It will be four stories high, 60x95 ft. Estimated cost, $25,000.

The Kline Kar Motor Co., Pittsburg, Penn., has awarded a contract for the construction of a large fireproof structure, to cost $30,000. The building will be used for a garage, repair shop, salesroom and offices. Noted Mar. 14.

Oscar Wagner, Port Allegheny, Penn., will erect a fireproof garage and repair shop.

The Palace Motor Car Co. will establish an automobile plant, at Rochester, Penn., for the manufacture of the Palace 40.

The plant of the Graff Furnace Co., Jackson St., Scranton, Penn., was damaged by a mine cave-in, Mar. 24, to the extent of $10,000.

Plans have been prepared for the construction of additions to the boiler department of the Struthers-Wells Iron Works, Warren, Penn. The estimated cost is $75,000. G. C. Lott is general manager. Noted Feb. 22.

SOUTHERN STATES

H. W. Steger & F. J. Laughon, Pulaski, Va., have let the contract for the construction of a fireproof garage, 50x125 ft. Work will be begun at once.

Fire destroyed the building at Dock and Twenty-second Sts., Richmond, Va., Mar. 26, occupied in part by the R. L. Barnes Safe & Lock Co., Inc., Boyd Iron Works, Inc., and the Richmond Cotton Oil Refinery Co. Total loss, partially covered by insurance, is $100,000.

The Chesapeake & Ohio Ry. will rebuild, remodel and enlarge its machine shops, at Huntington, W. Va. A new shop, 75x200 ft., two stories high, of steel construction, will be erected and also a 200-ft. boiler shop. F. I. Cabell, Richmond, Va., is chief engineer.

The American Radiator Co., Birmingham, Ala., will construct a factory, to cost $1,000,000.

The Ingalls Iron Works, Birmingham, Ala., contemplates doubling the capacity of its plant for the manufacture of fire escapes and steel stairways.

Dugger & Willis have purchased the shops of the Mt. Pleasant Auto Machine Co., Mt. Pleasant, Tenn., and will conduct a machine and repair shop. They will also establish a casting foundry.

The erection of a factory, at Paris, Tenn., has been completed by the National Toilet Co., and machinery is to be installed. Elevators and electric motors will be needed.

Joseph Mobley will install machinery in an automobile repair shop, at Elizabethtown, Ky.

MIDDLE WEST

The Hess Spring & Axle Co., Cincinnati, Ohio, will erect an addition to its plant, on Cook St.

The Scientific Heater Co., Cleveland, Ohio, will install a shop for the manufacture of gas furnaces and boilers in the Whitney Power Building.

The Ella Furnace Co., Cleveland, Ohio, incorporated for $200,000 by I. L. Evans, H. G. Dodge and others to build and equip a blast furnace.

The Ornamental Iron & Bronze Co., Cleveland, Ohio, has raised its capital to $60,000, and will buy some new machine-shop tools.

The Defiance Machine Works, Cleveland, Ohio, has increased its capital from $100,000 to $600,000. Plans are being prepared for several new buildings. Machinery will be purchased for the manufacture of wood and iron-working machinery. William R. Strickland is the secretary.

The Whitman Manufacturing Co., Cleveland, Ohio, will erect an addition to its plant and a boiler house, at 3819 Iron St.

The Ralston Steel Car Co., Columbus, Ohio, is making improvements and erecting additions to its plant. New machinery will be purchased.

The Crestline Manufacturing Co., Crestline, Ohio, will build an addition to its machine shop.

The National Cash Register Co., Dayton, Ohio, is considering plans for the construction of a new iron foundry, for the manufacture of iron castings. John H. Patterson is president.

The People's Street Ry. Co., Dayton, Ohio, will build a new car house and machine shop, to cost $80,000.

The Pittsburgh Tile & Manufacturing Co., East Liverpool, Ohio, will erect a factory for the manufacturing of sewer pipe and tiles. E. P. Lippincott, Wallace Miller and Robert Thompson, of Pittsburg, Penn., are the incorporators.

The Akron Aviation Co., Lakewood, Ohio, has been organized to equip a factory to manufacture aëroplanes. J. R. Gammeter, J. L. Weeks and J. D. Kelly are interested.

Fire destroyed part of the plant of the Baumgardner Manufacturing Co., Lakewood, Ohio.

The Miami Cycle & Manufacturing Co., Middletown, Ohio, are having plans made for the construction of a four-story concrete factory, 60x286 ft. Bert Baldwin and G. Barkman are architects.

The New Idea Seed Cleaner Co., Shilo, Ohio, was incorporated by P. L. Willit and others, to build and equip a factory.

The Kent Machine Co., Toledo, Ohio, will erect a new plant, to cost $50,000, on Lindsay St.

The Youngstown Sheet & Tube Co., Youngstown, Ohio, is having plans prepared for the construction of a new mill. It will be one story high, 100x400 ft., of brick and steel.

The Motor Necessities Co., Youngstown, Ohio, has been organized, with a capital of $10,000. A factory will be built at once. C. T. Gaither is president.

The International Steel & Iron Construction Co., Evansville, Ind., will enlarge and improve its plant.

An appropriation of $56,000 has been granted for improvements in the roundhouse of the shops at Washington, Ind., by the Baltimore & Ohio Southwestern R.R. Co.

The Indianapolis Traction & Terminal Co., Indianapolis, Ind., is preparing to ask for bids for the erection of a car barn, 800x800 ft., at Oriental St. and Highland Ave. The structure will be a fireproof brick, stone, concrete and steel building.

The Pipe Machine Co., 307 West Maryland Ave., Indianapolis, Ind., has awarded the contract for the construction of a new machine shop, on Elder St. It will be one story high, brick, 40x120 ft.

The Standard Oil Co. is erecting a $9000 garage, in Indianapolis, Ind., for the accommodation of the motor equipment. The garage, 38x125 ft., is of brick and steel construction.

W. S. Joy & Co., 606 Ferguson Building, Detroit, Mich., is preparing plans for a two-story and basement garage, 100x120 ft. It will be of reinforced concrete. The estimated cost is $25,000.

Rogers & Bonnak, 1310 Penobscot Building, Detroit, Mich., are preparing plans for a one-story factory, 30x104 ft., for the Robinson Automatic Machine Co., Russell St. and Milwaukee Ave. The estimated cost is $25,000.

The Suburban Motor Car Co., recently incorporated, with a capital of $500,000, contemplates the erection of a plant, at Ecorse, a suburb of Detroit, Mich.

The Day Automobile Co., manufacturer of the Day utility car, Detroit, Mich., is now located in its new factory, at 25 East Milwaukee Ave., Detroit, Mich. New equipment will be needed.

The American Brass Foundry, Detroit, Mich., is erecting a new factory, on Crystal Ave.

The United States Quilting Co., 509 West Division St., Chicago, Ill., will build a new factory and machine shop.

An explosion at the McCormick branch of the International Harvester Co., Chicago, Ill., burned several buildings and caused the death of three persons. The loss was $150,000.

The Mechanical Manufacturing Co., West Thirty-ninth St. and Packers Ave., Chicago, Ill., was destroyed by fire. Loss, about $50,000. The company will rebuild.

The plant of the Mechanical Manufacturing Co., manufacturer of posts and road scrapers, Union Stock Yards, Chicago, Ill., was damaged by fire, Mar. 25. Loss, $50,000.

The Ingals-Shepard Forging Co., Harvey, Ill., is completing an addition to its plant, 50x100 ft.

The Frost Engine Co., Evansville, Wis., has been incorporated and will erect a plant for the manufacture of gasoline and oil engines. Capital, $20,000. Incorporators are F. S. Frost, W. H. Johnson, W. B. Meggott and others.

A new factory for the manufacture of pneumatic tools will be built by the Giddings & Lewis Manufacturing Co., Fond Du Lac, Wis.

The Evinrude Motor Co., Milwaukee, Wis., will erect a new two-story plant, 75x140 ft., at Walker and Reed Sts. It will be of reinforced-concrete construction.

The Evered Foundry & Machine Works, Superior, Wis., has started construction on two buildings, at 122-32 Ogden Ave. and will remove its plant.

WEST OF THE MISSISSIPPI

The Des Moines Silo Manufacturing Co., Des Moines, Iowa, will erect a plant, on North Fourth St. and New York Ave. It will include a foundry, machine shop and warehouse.

Bids will be received by Dr. N. A. Biorn, Ada, Minn., until 8 p.m., Apr. 10, for the construction of a garage, 50x100 ft., 12 ft. high, to be built of cement or other fireproof material, with cement floor.

The Hurst Automatic Switch & Signal Co., 423 Central National Bank Bldg., St. Louis, Mo., has announced the purchase of 131 acres, known as the Massey place, and lying between Kinlock and Bridgton, upon which it will erect a manufacturing plant, to cost $250,000.

The Plainview Machine & Auto Repair Shop, Plainview, Tex., will construct a new machine and repair shop. E. E. Ross is general manager.

WESTERN STATES

The Brown-Lewis Co., Walla Walla, Wash., manufacturers of farming implements, will erect a new manufacturing plant, at Kirkland, Wash.

The Atchison, Topeka & Santa Fé Ry. is planning the addition of a reinforced-concrete blacksmith shop and foundry to its plant, in San Bernardino, Calif. The estimated cost is $50,000.

CANADA

Sir Donald Mann, Vancouver, B. C., is contemplating the erection of a plant, at Port Mann., B. C., for the manufacture of pig iron.

Bids will be received until April 18, for labor and materials required to erect a machine shop at the city yards, Ross Ave. and Tecumseh St. Plans are on file at the office of the City Engineer, 223 James Ave., Winnipeg, Man. M. Peterson, secretary Board of Control Office.

General Manufacturing

NEW ENGLAND

The steam laundry of George A. Chapman, Saco, Maine, has been totally destroyed by fire. Loss, $15,000.

The French & Heald Co., Milford, N. H., will erect a furniture manufacturing plant on Nashua St., to cost $100,000.

The abattoir of the Brighton Packing Co., Boston, Mass., was damaged by fire, Mar. 30. Loss, $200,000.

The Goodyear Tire & Rubber Co., Boston, Mass., is planning to erect an addition.

Fire greatly damaged the packing plant of Bachelder & Snyder, Brighton, Mass.

A large addition to the Germania Woolen Mills on South St. is being considered.

The Donoghue Silk Co., Holyoke, Mass., will erect a new mill, at Cabot and Commercial Sts.

The Ludlow Manufacturing Associates, Ludlow, Mass., manufacturers of yarns, twine, cordage, etc., will erect a large hydro-electric power plant for furnishing power to the plant at Ludlow.

Fire damaged the plants of the Brighton Packing Co. and the Boston Hide & Skin Co., at North Brighton, Mass. Loss, $100,000.

The Dennison Manufacturing Co., South Framingham, Mass., manufacturer of paper novelties, will erect a five-story addition, 175 ft. long.

Fire destroyed the plant of the Manufacturers' Woolstock Co., at Sutton, Mass., Apr. 2. Loss, $75,000.

Samuel M. Green, Inc., architects, Springfield, Mass., are preparing plans for a new factory building, to be erected at the foot of Sargent St., for the Taylor-Burt Paper Co. It will be of brick, four stories high.

George P. B. Alderman & Bro., architects, are preparing plans for the new bakery building, to be erected on Chicopee St., Willimansett, Mass., for the Dietz Baking Co., Holyoke, Mass. It will be of brick, 80x100 ft., two and three stories high.

The Mason Weaving Co., Westboro, Mass., manufacturers of tape, will erect a new factory on a site recently acquired.

Work will soon be started on the two-story brick addition to the factory of the A. & E. Henkel Lace Co., on the north side of Connecticut Ave., Bridgeport, Conn.

The Wise-Smith Co., Hartford, Conn., will install cold-storage and electric-power plants in connection with its proposed nine-story department store.

Plans have been completed by Burton A. Sellew, architect, for an addition to the laundry on Affleck St., Hartford, Conn., for R. Forastiere. It will be of brick and concrete, mill construction, 25x30 ft., one story.

The Strouse Corset Co., New Haven, Conn., will erect a three-story fireproof brick or reinforced-concrete addition, 47x70 ft. Plans have been prepared.

The contract has been awarded for the erection of a brick addition to the factory of the Ponemah Mills, Taftville, Conn., manufacturers of cotton goods. The plans were prepared by Engineers E. P. Sheldon & Sons, of Providence, and provide for a brick building costing about $50,000.

Architects are now completing plans for the new factory building for H. Hall & Co., manufacturers of pipe organs, to be erected on Campbell Ave., West Haven, Conn. The building will be 40x150 ft., of brick, mill construction, two stories high.

Plans are ready for bids for the addition to the factory of the Hemingway & Bartlett Silk Co., at Watertown, Conn. It will be 40x80 ft., two stories. Noted Feb. 28.

MIDDLE ATLANTIC STATES

The plant of the Regal Broom Co., Amsterdam, N. Y., has been damaged by fire.

A two-story concrete addition, 60x100 ft., will be built by the Faith Knitting Works at its plant at Averill Park, N. Y. William Mahoney is president.

The one-story building at 316 Eckford St., Brooklyn, N. Y., occupied by the Spotless Cleaning Co., was damaged by fire, Mar. 30. Loss, $3100.

The building at Livonia and William Aves., Brooklyn, N. Y., was damaged by fire, Apr. 4. The building was occupied in part by Canter & Ryttenberg, shirt manufacturers, damage, $5000; Max Mendelson, manufacturer of children's clothes, damage $5000.

The Sherman Harness Co., Buffalo, N. Y., has purchased a three-story brick factory, 30x130 ft., at Broadway and Pine Sts. The company will remodel and equip for the manufacture of harness and other leather goods.

The Empire Last Co. is having plans prepared for the erection of a new factory in East Rochester, N. Y.

The Peter & Koehler Chocolate Co., Fulton, N. Y., is building an addition to its factory to cost $5000.

The E. Z. Opener Bag Co., Fulton, N. Y., is planning an addition to its factory to cost $8000.

The Nestle Food Co. will enlarge its plant at Fulton, N. Y.

Fire causing a loss of $2000 destroyed the boiler house of the Vermont Slate Co., Granville, N. Y.

The Minetto-Meriden Co., Minetto, N. Y., has awarded the contract for the construction of an addition to its power house. It will be 90x99 ft., two stories high, of brick.

The buildings at 623, 625 and 627 Broadway, New York, were burned, Mar. 27, at a loss of $250,000. The buildings were occupied in part by Bonavitz, Goldstone & Co., cloak and suit makers, the Simon Kohen Clothing Co., the Lily of France Corset Co., and the Nofade Shirt Co.

A fire gutted the three top floors of a six-story factory, at 514 and 516 West 46th St., New York, on Mar. 29. The floors were occupied, respectively, by Wilson & Co., manufacturers of wood trimmings, A. B. Brown, manufacturer of screens and weather strips, and Rubin & Sabin, manufacturers of clothing.

The second floor of a seven-story building, at 103 Crosby St., New York, occupied by Hubbell & Bennings, manufacturers of caps, was burned, Mar. 30. Loss, $5000.

The top floor of the 12-story building, at 143 West Thirtieth St., New York, occupied by J. W. Litwin, manufacturer of ladies' waists, was burned, Mar. 30. Loss, $5000.

The car barns of the Rochester, Syracuse & Eastern Ry. Co., at Newark, N. Y., were destroyed by fire Apr. 1. Loss, $15,000, partly covered by insurance.

The Poughkeepsie Button Manufactory, Poughkeepsie, N. Y., will erect a plant, at Fairview, near Poughkeepsie.

A large brick addition will be built by W. H. Utter & Son, manufacturers of tobacco pipes and accessories, to their factory in South Third St., Olean, N. Y.

The contract for the construction of a new factory for the Alderman Fairchild Co., manufacturer of paper boxes, 29 Elizabeth St., Rochester, N. Y., has been awarded. The structure will be four stories high, 72x254 ft., of reinforced-concrete.

The Common Council, Yonkers, N. Y., has ordered plans prepared for the installation of an incinerating plant with a capacity of 120 tons of garbage daily.

The H. W. Johns-Manville Co., N. Y., 100 William St., New York, N. Y., will erect a new plant, at Finderne, N. J. Bids have been opened.

Fire has destroyed the plant of the R. P. Sword Co., Mount Holly, N. J., manufacturer of fireproof felt roofing.

An explosion, Apr. 2, damaged the Laflin & Rand Powder Works, at Wayne, N. J.

The Redcay Hat Co., Adamstown, Penn., will erect a new factory.

Plans are being prepared for rebuilding the plant of the Avoca Silk Mill Co., Avoca, Penn., recently destroyed by fire. Noted Apr. 4.

The city council of Bethlehem, Penn., has voted $50,000 for the improvement of the water-works system.

The building at 36 Pike St., Carbondale, Penn., occupied by the Carbondale Dye Works, was completely destroyed by fire, Mar. 27.

The United States Asbestos Co., Manheim, Penn., will build a weaving and spinning mill, 100x220 ft., two stories, of brick and stone. Kendall, Taylor & Co., Boston, Mass., are the architects. The estimated cost is $30,000.

A three-story manufacturing plant is being erected for the E. J. Spangler & Co., makers of envelopes, at 1241-5 Howard St., Philadelphia, Penn. The cost will be $12,700.

The one-story silk mill of Frank Malloney, at 2834 Boudinot St., Philadelphia, Penn., was burned, Mar. 29. Loss, $2500.

The Pittsburg Provision & Packing Co., Herrs Island, Pittsburg, Penn., is receiving bids for the construction of a new plant, to be built at Cumberland, Md., to replace the one recently destroyed by fire.

The Pennsylvania Light & Power Co., Northside, Pittsburg, Penn., will make additions to its power plant, including additional boiler capacity and the installation of stokers.

The plant of the Neversink Dyeing Co., Reading, Penn., was damaged by fire with loss of $500, on Apr. 2.

The plant of the Shawmut Vitrified Brick Co., Shawmut, Penn., was destroyed by fire, Mar. 31. Loss, $50,000, partially covered by insurance.

Bids will be received until Apr. 12, by the Board of Trustees of the State Hospital, for the erection of an incinerator. S. W. Waters is secretary, Warren, Penn.

William Suchting & Sons, Inc., box makers, 608 Portland St., Baltimore, Md., are having plans prepared for the erection of an addition to their factory.

Otto G. Simonson, architect, American Building, Baltimore, Md., is preparing plans for the construction of a factory for McCawley & Co., manufacturers of overalls and working shirts, 111 East Lombard St., Baltimore.

The William E. Hooper & Sons Co., manufacturer of cotton duck, Maryland Life Building, Baltimore, Md., has awarded the contract for the erection of an addition to its plant in Woodberry. The structure will be of brick and steel, 102x158 ft. Noted Feb. 27.

The Bagby Furniture Co., Baltimore, Md., will erect an addition to its furniture plant, to cost $20,000.

The Assau Canning Co., Baltimore, Md., will build an addition to its factory at Boston and Patuxrent Sts. The plans prepared by H. E. Feldhouse, architect, call for a two-story brick building, 95x114 ft.

W. Suchting & Sons, Inc., box makers, 608 Portland St., Baltimore, Md., will erect a large addition to their factory.

Bids will be received until 11 a.m., Apr. 13, by the Bureau of Yards and Docks, Navy Department, Washington, for garbage crematories at the navy yards, Puget Sound, Wash., and Norfolk, Va., and at the naval training station at San Francisco, Calif. William M. Smith is acting chief of bureau.

SOUTHERN STATES

Plans are being prepared by C. Taylor Holtzclaw, architect, Hampton, Va., for the construction of a new canning plant for J. S. Darling & Son. It will be three stories high, 80x100 ft., of brick. Estimated cost is $30,000.

The Rappahannock Woolen Mills, Laurel Mills, Va., has awarded the contract for rebuilding its plant recently destroyed by fire. The building will be 51x77 ft., three stories high of reinforced-concrete construction. Fred S. Hinds, 19 Milk St., Boston, Mass., is the architect.

The contract for the construction of a water, light and sewer system, at Lawrenceville, Va., has been awarded to the J. B. McCrary Co., Third National Bank Building, Atlanta, Ga., at $50,000.

Baugh & Sons Co., Norfolk, Va., will erect a fertilizer plant, at Burton's Point, at a cost of $250,000.

The Owens Eastern Bottle Co., Toledo, Ohio, has purchased land in Clarksburg, W. Va., and will have plans prepared for the construction of a bottle manufacturing plant. The estimated cost is $500,000.

The Taggard Valley Lumber Co., Elkins, W. Va., will rebuild its plant, recently destroyed by fire, at a loss of $100,000.

The Baltimore & Ohio R.R. will build a large creosoting plant, at Green Spring, W. Va.

Work was started on the proposed factory, Mar. 25, for the Fostoria Glass Works, Wheeling, W. Va.

The Catawba Ice & Fuel Co., Spencer, N. C., has awarded the contract for the erection of an ice plant. The main building will be of brick, 70x250 ft., fireproof construction. J. W. Hines is president.

The Armour Packing Co., Union Stock Yards, Chicago, Ill., is receiving bids for the construction of a three-story plant, of brick, to be erected at Columbia, S. C.

The Columbus Barrel Manufacturing Co., Columbus, Ga., will rebuild its machine shop, at a cost of $18,000.

The Cremo Co., manufacturer of disinfectants and sanitary equipments, will build a branch plant, costing $75,000, in Savannah, Ga. Henry D. Tatem, Buffalo, N. Y., is general manager.

The factory of the Southern Fertilizer Co., Orlando, Fla., was damaged by fire, Mar. 29. Loss, $8000. Insurance, $5000.

The city of New Orleans, La., will construct a cold-storage plant at the Dryades Market. It will be 43x117 ft., of brick. The estimated cost is $12,000. W. J. Hardee is city engineer.

The Harriman Riverside Woolen Mills, Harriman, Tenn., is erecting a large addition to its plant. William E. Parham is general manager.

The Racy Cream Co., Knoxville, Tenn., has had plans prepared for the construction of a paper-bottle plant. The estimated cost is $15,000.

The plant of the Consignee Favorite Box Co., Ridgedale, Tenn., was partially destroyed by fire, Mar. 28. Loss, $10,000.

James S. Patton, Catlettsburg, Ky., is considering the erection of a paper mill.

The Greenville Light & Water Co., Greenville, Ky., will erect an electrical power-plant and transmission line from Greenville to Central City, Ky.

The Ohio River Contract Co., Evansville, Ind., will erect a planing mill, near Henderson, Ky., for the manufacture of lumber used in the concrete work of a lock and dam for the government.

W. E. Barron will erect a large steam laundry, in Lexington, Ky.

The Burley Tobacco Society, Lexington, Ky., will install a prizing and redrying plant, at Mt. Sterling, Ky., requiring the use of power machinery and steam for drying purposes.

The distillery of the John T. Barbee Co., Louisville, Ky., was recently destroyed by fire, at a loss of $7500. The plant will be rebuilt immediately. Herman Volkerding is general manager.

George W. Wallingford & Son, Maysville, Ky., will erect a large plant for the manufacture of gloves.

The Climax Roller Mills Co., Shelbyville, Ky., is erecting a large grain elevator, and will need equipment, including a 75-hp. engine.

MIDDLE WEST

The Pittsburg & Buffalo Coal Co., Buffalo, N. Y., is erecting a coal dock at Ashland, Ohio.

The American Fabric Belting Co., Cleveland, Ohio, belt makers, has increased its capital and will make additions to plant.

The city council of Cleveland, Ohio, has been authorized to erect a sewage-testing plant, at the cost of $20,000. Charles W. Lapp, president, and W. J. Springborn, director of public service.

The Union Gas & Electric Co., Cincinnati, Ohio, will erect a substation, to cost $18,000, to be used for city lighting purposes. The corporation is doubling the size of its plant at Camp Washington.

Fire destroyed the cut-stone plant of Franklin Alter, Cincinnati, Ohio, operated by the Kentucky Freestone Co., at Mt. Vernon, Ky., to the extent of $7500.

Jasper Cohagen has started work on the erection of a four-story brick addition to the Bradford Shoe Co., Columbus, Ohio, factory building on Neilston St. Estimated cost, $20,000.

The McClintock-Marshall Co., Columbus, Ohio, has started work on the erection of a large factory for the Kilbourne & Jacobs Manufacturing Co., Columbus.

The Elyria Iron & Steel Co., Elyria, Ohio, will make additions to its power plant.

F. W. Guinshi will build an oil refinery, at Junction City, Ohio, to cost $1,000,000.

The P. A. Sorg Paper Co., Middletown, Ohio, has had plans prepared for the construction of an addition to its mill, on Second St. The estimated cost is $400,000.

The North American Chemical Co., Springfield, Ohio, will erect a factory north of the Eagle glass factory.

The North America Chemical Co., Urbana, Ohio, is having plans prepared by Emory & Eisenbrey, engineers, 1103 Harrison Building, Philadelphia, Penn., for the construction of a new plant for the manufacture of alum. The structure will be one and two stories, of fireproof construction, and cost $25,000. The capacity will be about 20 tons of halloysite ore per day.

The Wooster Nursery Co., Wooster, Ohio, will buy new heating plant and pumping equipment for large greenhouses which it will erect.

The Ohio Agricultural Experiment Station will receive bids until Apr. 25, at Wooster, Ohio, for power-plant and electrical equipment.

The Union Wholesale Lumber Co., Youngstown, Ohio, incorporated to operate a large lumber mill, by W. H. Palmer. L. K. Frank will buy power-plant equipment and wood-working machinery.

The Wagner Quarries Co., Sandusky, Ohio, incorporated for $500,000 by C. E. Wagner and A. M. Michel, to operate a large quarry, at Sandusky, Ohio.

Plans are being prepared by Frank B. Hunter architect, State Life Building, Indianapolis, Ind., for the construction of a brick factory, mill construction, two stories high, 45x100 ft., for the Indianapolis Brush & Broom Manufacturing Co. The estimated cost is $80,000.

William Sutton, Muncie, Ind., is building a canning factory at Daleville, Ind.

The Murphy Chair Co., Detroit, Mich., is erecting a factory on Trombley Ave.

Harley & Atchison, 504 Bowles Building, Detroit, Mich., are preparing plans for a two-story and basement factory, 40x100 ft., for the Rumsey Wool Sock Co., Romeo, Mich. The estimated cost is $25,000.

The Pope Baking Co., Detroit, Mich., is building an addition to its plant.

The Garden City Bottling Works, Twenty-first Place and Albany Ave., Chicago, Ill., are having plans prepared by Northman & Steinbach, architects, Halstead St. and Englewood Ave., for the construction of a new factory, two stories high, 65x75 ft., of brick, on Paulina St. The estimated cost is $30,000.

The Carter White Lead Co., 12,042 Peoria St., Chicago, Ill., has had plans prepared for the construction of a new factory, at West Pullman, Ill. It will be three stories high, 100x125 ft., of brick and steel.

Fire damaged the cooperage shop of the Independent Packing Co., West Forty-first & Emerald Ave., Chicago, Ill.

Swift & Co. will build a seven-story brick cold-storage plant at West Forty-second and Justin Sts., Chicago, Ill., and equip it throughout with new material and machinery.

The car barn of the Chicago City Ry. Co. at Archer Ave. and Pitney Court, Chicago, was destroyed by fire, Mar. 29. Loss, $25,000, covered by insurance.

William Erley, Chicago, Ill., will erect a four-story concrete carriage factory at 123 West Indiana St. A. R. Weinz is the architect.

The Dairy Farm Products Co., Chicago, Ill., will erect a large plant to cost about $200,000.

Leavitt Co., Urbana, Ill., will improve its plant recently destroyed by fire. A new two-story building will be erected, entirely fireproof, with brick and concrete.

Reardon Bros., Waukegan, Ill., have awarded the contract for the erection of a three-story addition, 50x70 ft.

The Federal Rubber Manufacturing Co., Cudahy, Wis., will spend $50,000 for 1912 construction work, which will consist mainly of erecting additions to connect all of its present group of manufacturing buildings here.

The Milwaukee Leather Belting Co., 451 Twelfth St., Milwaukee, Wis., has awarded the contract for remodeling its factory, and building a 34x42-ft. addition. Estimated cost, $12,000.

Lewis & Kitchen, Chicago, Ill., will prepare plans and specifications for the incinerator plant, at Racine, Wis., to cost about $20,000.

WEST OF THE MISSISSIPPI

A grain elevator owned by T. J. Allen, Fort Dodge, Iowa, was destroyed by fire, Mar. 26. Loss, $14,000, half covered by insurance.

The engine and pump house of the water system, at Gowrie, Iowa, was destroyed by fire, Mar. 24.

The building and stock of the Luce Trunk Co., 1026 Main St., Kansas City, Mo., was damaged by fire. The fire spread to the building of the Raymond Cloak Co., next door, causing a damage of $5000.

The Spring Lake Canning Co., Mammoth Spring, Ark., will erect a canning plant. P. O. Weller is president.

The Anchor Milling Co., Galveston, Tex., will build a mill for the grinding and bolting of cotton-seed cake. A building 60x120 ft., of corrugated iron, will be erected. The estimated cost is $45,000.

The Tamalina Milling Co., San Antonio, Tex., is erecting a grist mill, at a cost of about $25,000. D. Martinez is president and W. Martinez, secretary.

W. D. Ellis and Cyrus Ellis will erect a cotton gin, at Candlish, Tex.

The contract for the construction of a new plant for the Industrial Cotton Oil Co., Houston, Tex., to replace the one recently destroyed by fire, has been awarded. The plant will consist of four one-story structures. The machinery building will be 100x500 ft., and three warehouses, each 80x480 ft. The estimated cost is $300,000.

The Guatemala Coffee Co., Houston, Tex., has awarded a contract for a new factory. It will be three stories high, 45x90 ft., and will be erected at 2409 Commerce St. The estimated cost of the plant is $25,000. Green & Finger, Houston, are the architects.

The Denver Lithographing Co., Denver, Colo., plans to construct a plant, at Twelfth and Lawrence Sts., at a cost of $50,000.

The Federal Light & Traction Co., New York, N. Y., has acquired the properties of the Deming Electric Light & Ice Co., Deming, N. M., and will erect a power plant and transmission lines, at a cost of $500,000.

WESTERN STATES

The Clarkson Fruit & Canning Co., Clarkson, Wash., will erect a branch canning plant, at Juliaetta, Idaho.

The Chlopeck Cold Storage Co., Seattle, Wash., will erect a plant of corrugated iron.

The Western Soap Co., Spokane, Wash., will erect an addition to its manufacturing plant, on Sinto Ave.

The ice and cold-storage plant, at Grand Pass, Ore., was destroyed by fire, Mar. 12. Loss, $10,000.

Plans have been completed for the construction of the new plant for the Portland Gas & Coke Co., to be erected at Linnton, Ore. The estimated cost is $3,000,000.

The Antioch Holding & Investment Co. has recently been incorporated and will build a plant at Antioch, Calif., for the manufacture of tiles and pottery. The officers of the company are W. Barnes, of San Rafael; W. H. Hall, of Oakland, and H. F. Beede, of Antioch. The capital stock is $200,000.

The plant of the Hood Knitting Co., Lindsay, Calif., was gutted by fire, Mar. 27.

E. M. Marco, Los Angeles, Calif., is contemplating the erection of a box factory, at Madera, Calif.

The Wade Encaustic Tile & Pottery Co., Los Angeles, Calif., will erect a pottery, at Vernon, near Los Angeles.

The Pacific Fruit Exchange, Fresno, Calif., plans to erect new packing plants at Fresno and other places in the San Joaquin Valley. W. C. Walker is manager.

J. Boren and H. Morrow, Oro Grande, Calif., plan to erect a cement plant, near Oro Grande.

The city of Modesto, Calif., has voted bonds for a modern water-works system. The estimated cost is $82,500.

The McRoskey Mattress Co., San Francisco, Calif., will erect a new manufacturing plant, at Sunnyvale, Calif.

The Armour Packing Co., Union Stock Yards, Chicago, Ill., is considering the erection of a new packing plant and warehouse, at Seventh and K Sts., San Diego, Calif., to cost from $75,000 to $100,000.

The Perfect Wall Bed Co., San Diego, Calif., recently incorporated, is planning the erection of a new plant. R. E. Crippen is president.

The Sacramento Natural Gas Co., Sacramento, Calif., has acquired the property of the Lodi Natural Gas Co., Lodi, Calif., and the improvements noted Mar. 14 will be carried out.

The Pacific American Fisheries Co., Bellingham, Wash., will erect a new canning plant, at Port Moller, Alaska, to cost $150,000.

CANADA

Bids are being received by the Canada Furniture Manufacturers, Ltd., Berlin, Ont., for the construction of a four-story brick factory, 60x153 ft.

The contract for remodeling Elevator D of the Canadian Pacific R.R., at Port Arthur, Ont., has been awarded to the Barnett & Queen Co., at $400,000. The capacity will be increased 1,600,000 bushels.

The Ontario Paper Co., recently incorporated, has purchased a plot of 25 acres at Thorold, Ont., on which it will erect a plant.

T. S. Simms & Co., St. Johns, N. B., manufacturers of brushes and brooms, will erect a 4½-story reinforced-concrete and hollow-tile factory, 52x400 ft., at Lancaster, N. B. Lockwood, Green & Co., 93 Federal St., Boston, Mass., are the architects.

The pumping station belonging to J. E. Armstrong, at Petrolia, Ont., was completely destroyed by fire, Mar. 28.

CANADA

The Beayer Board Co., Buffalo, N. Y., will erect a one-story brick manufactory, 80x500 ft., at Ottawa, Que.

The Shevlin-Clark Co., Weyerhaeuer-Lumber Co. and the Hines Lumber Co. have consolidated their interests, at Fort Frances, Ont., and will build several large sawmills.

The British-Canadian Canners, Ltd., has awarded the contract for a fruit and vegetable canning plant, at Port Robinson, Ont., to cost $30,000.

The planing mill of James A. Cole & Co., North Bay, Ont., was almost entirely destroyed by fire, Mar. 28. The plant was valued at $30,000. Insurance, $9000 on mill and $5000 on lumber.

Fire destroyed the car barns of the Oshawa Ry. Co., Oshawa, Ont., Mar. 29. The barns were totally destroyed, together with contents, including two large passenger cars, one small passenger car, one freight motor and street sweeper. Loss, $20,000.

The Ogilvie elevator and flour and feed warehouse, Morden, Man., was burned, Mar. 30.

The Yale-Columbia sawmill, at Nelson, B. C., was destroyed by fire, Mar. 20. Loss, $75,000.

New Incorporations

METAL WORKING

The Tucker Garage Co., Inc., Middletown, Conn., has been incorporated with a capital of $50,000, to conduct a garage. The incorporators are Willard D. Tucker, G. Howard Tuttle and Clare H. Blatchley.

The Connecticut Turbine Manufacturing Co., New London, Conn., has been incorporated with a capital of $75,000. The incorporators are William L. Hopson, Thomas F. Foran and Charles H. Klinck.

The Noye Brothers Co., Buffalo, N. Y., has been incorporated with a capital of $5000 to repair and construct mill machinery. The incorporators are Albert A. Noye, Richard K. Noye, Jr., and Elizabeth M. Nauth.

The Davies' Patents Manufacturing Co., New York, N. Y., has been incorporated, with a capital of $30,000, to manufacture machinery and tools. The incorporators are F. D. Davies, Brooklyn; F. C. Bonny and R. Louden, New York, N. Y.

The Pierce, Wells & Keedwell Co., New York, N. Y., has been incorporated with a capital of $10,000 to manufacture motors, engines and machinery. The incorporators are Peter Krulder, Bronx; Albert C. Keedwell and Albert D. Keedwell, 171 West Eightieth St., New York, N. Y.

The Near-side Car Co., New York, N. Y., has been incorporated, with a capital of $250,000, to manufacture railroad equipment and street cars. The incorporators are J. A. Ford, P. M. Albro and C. C. Vaughan, Buffalo, N. Y.

The John Brown's Sons Co., Olean, N. Y., has been incorporated with a capital of $25,000 to manufacture cutlery and tools. The incorporators are W. R. Brown, Tidioute, Penn.; J. W. Brown, Little Valley, N. Y., and R. E. Brown, Olean.

The Consolidated Gas Machine Co., Rochester, N. Y., has been incorporated with a capital of $75,000 to manufacture gas machinery. The incorporators are M. D. Colbath, L. I. Willsea and T. W. Richardson.

The Pembroke Manufacturing Co., Rochester, N. Y., has been incorporated, with a capital of $50,000, to manufac ure and deal in automobile supplies and accessories. The incorporators are C. J. Pembroke, W. P. Pembroke and W. J. Fellows.

The Xargil Kerosene Engine Co., Utica, N. Y., has been incorporated, with a capital of $100,000, to manufacture motors, machinery and engines. The incorporators are B. F. Gilbert, G. A. Frisbie and J. A. Xardell.

The Belleville Copper Rolling Mills, Belleville, N. J., has been incorporated with a capital of $50,000. The incorporators are H. W. Hendricks, E. J. Keans and G. A. Dorer, Belleville.

The Steinbock Engineering Co., Edgewater, N. J., has been incorporated with a capital of $1,000,000 to manufacture automobiles and motor cycles. The incorporators are E. J. Forhan, F. B. Knowlton and J. McLaren, New York, N. Y.

The Spicer Tabulating Machine Co., Washington, D. C., has been incorporated with a capital of $200,000 to manufacture tabulating machines. The incorporators are C. W. Spicer, J. E. Hutchison, Jr., and E. Edmonston, Jr., Washington.

Citizens' Automobile Co., Chattanooga, Tenn., has been incorporated with a capital of $15,000 to conduct a garage. Incorporated by C. W. Howard.

The Lewis File Co., Peach City, Ohio, has been incorporated, with a capital of $10,000, to operate a general machine shop. The incorporators are David D. Lewis, Ella Lewis and Wesley M. Siefer.

The Cleveland Gas Floor Furnace Co., Cleveland, Ohio, has been incorporated with a capital of $15,000 to manufacture gas furnaces, stoves and lighting apparatus. The incorporators are J. T. Kelley, S. M. White and J. D. Kelly.

The Jockers Electric Fixture Co., Cleveland, Ohio, has been incorporated with a capital of $5000 to manufacture electric fixtures. Incorporated by George W. Jockers.

The Apple Electric Co., Dayton, Ohio, has been incorporated with a capital of $300,000 to manufacture automobile starters. The incorporators are V. G. Apple, Oscar Apple and J. C. Slager.

The Multi-Rate Co., Dayton, Ohio, has been incorporated with a capital of $10,000 to manufacture counting machines. The incorporators are H. E. Talbot, A. O. Davidson, Joseph Crane and Charles E. Craighead.

The Dayton Iron & Steel Co., Dayton, Ohio, has been incorporated with a capital of $50,000 to manufacture iron and steel products. Incorporated by William Dennick.

The Swanton Manufacturing Co., Swanton, Ohio, has been incorporated with a capital of $5000 to manufacture metal tanks, troughs, poultry fountains, incubators and eaves troughs. The incorporators are Christopher Gleeker, Charles C. Schell and William Knierim.

The Westerfield Engine Starter Co., Indianapolis, Ind., has been incorporated with a capital of $5000. The incorporators are G. G. Westerfield, C. F. Hunt and J. E. Spaan.

The Thomson Pneumatic Tool Co., Indianapolis, Ind., has been incorporated with a capital of $10,000. The incorporators are C. L. Thomson, Albert Thomson and H. F. Dorman.

Business Items

The American Electric Tool Co., West Newton, Mass., has opened a New York office, at 50 Church St., with Chas. H. Gresslee as manager. Mr. Gresslee was formerly New York manager for the Crescent Oil Co.

The Lucas Machine Tool Co., Cleveland, Ohio, has been awarded a gold medal and diploma at the Brussels Exposition in 1910 for their "precision" horizontal boring, drilling and milling machine, which was exhibited by Alfred H. Schutte.

Forthcoming Meetings

National Metal Trades Association. Fourteenth annual convention, Apr. 11, Hotel Astor, New York City. Robert Wuest, commissioner, New England Building, Cleveland, Ohio.

American Supply and Machinery Manufacturers' Association, National Supply and Machinery Dealers' Association, Southern Supply and Machinery Dealers' Association. Triple convention, May 13-15, Norfolk, Va., Hotel Monticello. F. A. Mitchell, secretary, 309 Broadway, New York City.

Master Boiler Makers' Association. Sixth annual convention, Fort Pitt Hotel, Pittsburg, Penn., May 14-17. J. Rogers Flannery, secretary arrangements committee, Flannery Bolt Co., Pittsburg, Penn.

National Machine Tool Builders' Association. Semi-annual convention, May 16-17, Atlantic City, Hotel Chalfonte. Charles E. Hildreth, secretary, Worcester, Mass.

American Society of Mechanical Engineers. Spring meeting, May 28-June 1. Hotel Hollender, Cleveland, Ohio. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

American Railway Tool Foremen's Association. Annual convention, Chicago, Ill., July 9, 1912. H. L. Mills, secretary, 835 Monadnock Building, Chicago, Ill.

American Society of Engineer Draftsmen. Regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies Building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton Building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Connecticut

PATTERN MAKERS—Six first-class, familiar with heavy machinery work. Farrel Foundry & Machine Co., Ansonia, Conn.

FOREMAN—Thoroughly competent for head of planer department, who is conversant with modern planing methods; references required. The Whitlock Printing Press Mfg. Co., Derby, Conn.

A MAN experienced in cold-rolling spring steel in all gages from 0.003 up to $\frac{1}{8}$ in. and drawing spring wire; must know what equipment is necessary and how to install same. Address P. O. Box 941, New Haven, Conn.

TRAVELING SALESMEN — Several first-class, who are in touch with all kinds of manufacturing plants, to handle a new electric-lighting device on commission and exclusive territory basis; state line and trade you handle. "S. L.," 103 Allyn St., Hartford, Conn.

DESIGNER—High-grade man for automatic wire- and metal-working machinery; preference will be given to a man who has had practical experience building and making tools for this class of machines; give outline of experience, wages expected, etc. Box 161, Am. Mach.

FOREMAN, to take charge of bolt-threading department; must thoroughly understand thread cutting in all particulars, also the operation of the various types of threading machines, and be competent to manage help; only first-class man need apply. Box 165, Am. Machinist.

Iowa

TOOL MAKERS on gas-engine jigs; punch and shear man on metal manure spreader; age, experience and wages expected. Address "Superintendent," Lock Box 317, Mason City, Ia.

Maryland

DRAFTSMAN, experienced on high-speed stationary engines. Box 112, Am. Machinist.

DRAFTSMEN, experienced on dredging machinery and marine work; also competent structural and hull draftsmen. Box 59, Am. Machinist.

Massachusetts

DRAFTSMAN—First-class on cotton-carding machinery. Apply stating age, experience and wages expected, to Box 155, Am. Machinist.

OPERATORS on Potter & Johnston and Gridley automatics; in writing state age, experience and pay desired. Box 156, Am. Machinist.

FOREMAN for milling machine department; an energetic, uptodate man of experience on medium and light work of commercial quality; in writing state wages expected, age and experience. Box 157, Am. Machinist.

DRAFTSMAN, experienced with electrical or high-speed steam-engine experience for a permanent position with a large manufacturing concern near Boston, Mass. Apply stating age, education, experience and salary expected by addressing "Chief Draftsman," Box 139, Am. Machinist.

TOOL MAKER, first-class, with executive ability, capable of designing jigs and fixtures; no one need apply without stating age, experience in full, pay required and references; this is a steady position with chance of advancement; location, 27 miles from Boston. Box 163, Am. Machinist.

ENGINEER-COST ACCOUNTANT—We wish to secure the services of a technical graduate who has had experience in industrial plants, preferably machine shops, since leaving college, and who understands from some practical experience the application, as well as the theory, of double-entry bookkeeping as applied to cost-accounting practice; applications should be as complete as possible, stating age, nationality, some account of college record, and specific details of subsequent experience. Clinton H. Scovell & Co., certified public accountants—industrial engineers, 40 Central St., Boston.

New Jersey

DRAFTSMAN; one who is accustomed to subpress and pillar die work, jigs, fixtures and small automatic machinery; permanent position to right man; factory located in Newark, N. J. Box 137, Am. Machinist.

New York

SALESMAN who thoroughly understands transmission of power, to travel in New York and New England. Box 176, Am. Machinist.

MACHINERY DRAFTSMAN and designer, first-class on automatic and special machinery; state references, experiences and salary expected. Box 175, Am. Machinist.

SALESMAN for cold-rolled strip and high-speed and carbon tool-steel mill; must have trade in New York and metropolitan district; good opening for right party. Box 158, Am. Machinist.

FOREMAN for automatic and turret lathe department; must be a hustler, thoroughly experienced and able to produce accurate work at the proper cost; steady position for the right man. Box 150, Am. Machinist.

Ohio

JIG AND DIE MAKERS, first-class, on small, accurate, interchangeable parts. Box 181, Am. Machinist.

SALESMAN, experienced, for Middle West, competent to furnish estimates and negotiate sales for presses, dies and equipment used in manufacturing sheet and bar-metal products; experienced men only need apply. Box 71, Am. Machinist.

MACHINE DESIGNER of automatic machinery; only those with broad experience and capable of holding position of chief designer need apply; state age, experience and present salary in first letter. Box 140, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

SUPERINTENDENT for plant manufacturing engines and boilers; 200 hands. Address "Dixie," Am. Machinist.

OPERATORS—Several Acme automatic screw machine operators, tool makers and gage makers. Address employment department, Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Rhode Island

YOUNG MAN, between 25 and 30 years, with knowledge of accounting, preferably with experience on factory accounting, for the cost department of a large manufacturing plant in Rhode Island; state education, experience and references. Box 164, Am. Machinist.

Wisconsin

ESTIMATOR, capable of setting exact time of operation on small interchangeable and repetition work from blueprints; automobile part experience preferred, though not essential; give full particulars and salary expected. Box 171, Am. Machinist.

POSITIONS WANTED

Massachusetts

CHIEF INSPECTOR—Competent man on machine tools and parts; thoroughly up to date and experienced in modern manufacturing methods. Box 141, Am. Machinist.

New Jersey

FOREMAN, practical mechanic, wide executive experience, machine tools, machinery, jigs, fixtures, etc., wants responsible position. Box 178, Am. Mach.

FOREMAN—Automatic screw machine foreman desires change; also turret lathes and hand screw machines; vicinity of New York. Box 172, Am. Mach.

MECHANICAL GRADUATE — Young man, 28 years of age, with seven years' practical experience; two years' shop, two years' assistant chief draftsman, three years' general office and sales work; present position offers no opportunity for future; what opening have you for a young man with executive ability? Box 169, Am. Machinist.

New York

FOREMAN, middle age, up to date on modern methods, pumps, electrical and general machinery; can get results. Box 159, Am. Machinist.

SUPERINTENDENT and manager of large concern desires change; have made good in present position for nine years. Box 168, Am. Machinist.

OPERATOR—First-class Gridley automatic operator wants steady position; have years of experience; would take charge. Box 174, Am. Machinist.

DRAFTSMAN, broad experience, mechanical and electrical design, tools and fixtures, desires permanent position. Box 179, Am. Machinist.

TOOL AND DIE MAKER, first-class, experienced designer of tools and automatic machinery; first-class references. Box 177, Am. Machinist.

MACHINE DESIGNER, 30; 11 years' experience in wrapping, weighing and tool machinery, development of inventions, etc., desires responsible position. Box 173, Am. Machinist.

SALESMAN, office manager, experienced in cost keeping, shop accounting, buying and selling; 32 years old; would prefer salesman's position; have years of experience in various kinds of special machinery. Box 183, Am. Machinist.

FOREMAN—Practical japanner and enameler, now employed as foreman, desires change; typewriters, adding machines or metal furniture preferred. Address "E. E. W.," Box 19, Madison Sq. Branch, New York.

TOOLMAKER, 35, experienced handling men, also developing, designing and building small automatic and organized machinery and tools, wishes position with inventor or manufacturer. Box 182, Am. Machinist.

DESIGNER, technical graduate, 29; ten years' experience automatic and general machine design, also experimental work and shop practice, desires position as assistant engineer or superintendent. Box 143, Am. Machinist.

FACTORY SUPERINTENDENT, who has held but two positions in the past 12 years making large quantities of the highest grade of mechanical products desires a change; would surrender present position in metal-working corporation if proper new opportunity presented; much success in mechanically perfecting factory products that require practical development, low cost of manufacture and to secure largest sales; executive ability has been proven by handling at increasing salary upward of 1000 men over a period of several years in present position. Box 160, Am. Mach.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

SUPERINTENDENT with large experience on high-grade machine tools and automatic machinery; familiar with modern methods; has ideas; can give first-class references; permanent location desired. Address "Superintendent R.," Am. Machinist.

Pennsylvania

MECHANICAL SUPERINTENDENT, expert mechanic, engineer, wants to make good connection; moderate salary. Box 95, Am. Machinist.

ENGINEERING or sales position with manufacturer of power or railway apparatus; applicant is 38 years of age, has technical education and practical training as mechanical electrical engineer and five years' experience on transportation work; can install and operate steam and gas engines or electric motors; thoroughly conversant with electric-car equipment and operation; at present employed but desire more active position. Box 134, Am. Machinist.

Rhode Island

SUPERINTENDENT, general foreman; have unit times tabulated; A1 results for A1 salary. Box 121, Am. Machinist.

Wisconsin

SUPERINTENDENT, by a production engineer, now with company producing heavy machinery and employing 1200 men; can increase output and decrease cost in a systematic way. Box 167, Am. Machinist.

MECHANICAL ENGINEER, with 12 years' experience, desires increased opportunities; a good designer, accustomed to handling men; experienced in shop organization and in developing systems for increased production. Box 166, Am. Machinist.

MISCELLANEOUS

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Production increased, quality improved. James F. Hobart, efficiency engineer, Box 133, Am. Machinist.

For Rent—Two-story brick factory, 7500 sq.ft., Plainfield, N. J. A. J. Brunson, Plainfield, N. J.

A line of medium weight or small machinery to manufacture wanted in quantities. Box 170, Am. Machinist.

Punches and dies to make for metal cutting, stamping or forming wanted. McCall Machine Works, Rochester, N. Y.

Good article to manufacture wanted; we have capital and sales organization. Ludwig Hommel & Co., Pittsburg, Penn.

Two or three second-hand Ferracute No. 52 or Stiles & Parker No. 2 presses wanted, in good order. Address with prices and location, Box 180, Am. Mach.

Machine shop in New England, fully equipped, wants to contract for small, light machinery; good foundry facilities and can turn out work quickly. Box 153, Am. Machinist.

Machine shop for sale in New England, manufacturing a standard line of well known machine tools; we own the buildings and lot, 75x150 ft., and are a going concern. Box 154, Am. Machinist.

"Cleveland Sixth City"—Selling rights for Cleveland and vicinity for good machine-tool line, tool steel or machine specialty desired by party about to open sales office. Box 162, Am. Machinist.

For Sale—A new 46-in. Seybold automatic knife grinder; cost originally $280; will sell for $160. Eastman Kodak Co., purchasing department, Rochester, N. Y.

Salesmen wanted to carry as a side line a small tool such as is used in every machine or metal-working shop; write for particulars. Star Manufacturing Co., Box 446, Westfield, Mass.

For Sale or Rent—In village of Albion, substantial stone building, 50x127 ft., from street to barge canal; well adapted for foundry and machine shop; no foundry within 10 miles or more; good location for business. G. H. Church, Bergen, N. Y.

For Sale—One 4¼ Cleveland automatic machine, also one 2¾ Cleveland automatic, and one No. 1 Brown & Sharpe universal grinder, in first-class condition. Address The Standard Machinery Co., Mystic, Conn.

Machine shops and foundries desirous of manufacturing and marketing a profitable specialty, in the line of fixture, device or machine requiring but little capital, should communicate with the Engineering Service Co., Box 463, Williamsport, Penn.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

For Sale—Atherton Machine Co.'s plant, manufacturing a line of special silk and textile machinery, also a miscellaneous local business; well equipped machine, blacksmith, pattern and woodturning shops and iron foundry; heirs wish to sell; an exceptional opportunity for a live man. Box 149, Am. Machinist.

Drawings, specifications, estimates and manufacture of jigs, fixtures, automatic machinery, special equipments, punches and dies by a corps of experts; write us your requirements for suggestion of ideas and cost estimates. Laurin & Sundstrom, 271 Hicks St., Brooklyn, N. Y.

Talks With Our Readers

By The Sales Manager

"Advertisements," said the Purchasing Agent, as we sat at luncheon in the company's dining room, "have always been a great time-saver for me; or, rather, they are now.

"Years ago, before I got onto the racket, so much of the day was taken up in seeing salesmen that I could hardly find time to attend to necessary correspondence."

"Well," said I, "how is it different now? They still come out to call on you, don't they?"

"Yes," he replied; "but now I'm prepared for them."

"How?" I inquired.

"Just this way," he answered. "You know, with the diverse lines of machinery built in these works for the industries we make a specialty of supplying, it is necessary to have a great variety of equipment; and, while I have always turned to our shop people for the final advice in matters of this kind, I have to keep pretty thoroughly posted, myself, in order to do the best possible for the company. There is something new coming out almost every week, and it's surprising how soon one's knowledge gets to be a back number. I found that out last winter when I went down to Cuba for a couple of months' vacation.

"Originally, I used to depend on the salesmen of the different tool and supply houses to keep me informed of the latest developments; but one day I was looking in the AMERICAN MACHINIST for the name of a manufacturer of screw machines whose address I had forgotten; and my attention was attracted, while turning the pages, to the sectional view of a manufacturing automatic. I had never heard of one before, and I afterwards learned that they had been on the market only a few months; but, if I had known of them when they first came out, it would have enabled us to take a big custom order for machining certain parts used on seeding machines. It was offered us and we needed it badly as a filler for our regular work, but we couldn't figure on it quite close enough with the equipment then available. I felt like kicking myself for not having seen the advertisement of the automatic machines before. When I told the old man about it he nearly had a spasm.

"Then I got to thinking about the calls I had had from salesmen and what these amounted to. It occurred to me that I was seeing pretty much the same men, over and over, and hearing the same old things. The salesmen who covered this territory regularly for certain houses always used to come out here, when nearby, on the odd chance of 'something doing.' They would sit around my office and smoke and talk and waste my time. I acquired a fund of good stories to tell here at the table; but, when I came to think it over, I wasn't learning much that I did not already know about equipment such as we have occasion to buy. More than that, I woke up to the fact that I wasn't even seeing the best class of salesmen. The busiest, best informed men didn't waste their own time or anyone's else. They represented, as a rule, the most progressive houses and were kept on the go, all the time, answering direct inquiries.

"Well, to cut the story short, I sent for a catalog of the manufacturing automatic mentioned, which was built way down East, and asked for an explanation of certain features that were not clear to me from the section shown in the advertisement. Accompanying the catalog was a very full reply to my questions, and I had a session with our shop people over the matter. When the Cincinnati representative of the concern came out to see us, about a week later, I was all primed, and he had sense enough not to go all over again with me the things I already understood. Instead, we went out in the shops together and he demonstrated what we could do with one of his machines, by showing photographs taken in our shops and using an ordinary screw lathe as an illustration. He came on the 11:05 train, had luncheon with me, and got away on the limited, which then left a little before 2:00 o'clock.

"Did you buy any of the machines?" I asked.

"You bet we did; and we more than got our money back in the profit on the first order we put through, which was a season contract. We used other tools on it, too, when they weren't occupied with other work, but the profit was made on the automatics. Two years ago, we had some of the machines rebuilt, with the latest attachments, by the concern we got them from, and the rest we traded in on others of a little different type."

"And what effect did this incident have on your subsequent interviews with salesmen?"

"Why, since that time, I've had a different system.

"When we need additional equipment or have to figure on a prospective contract which may involve putting in new machines, one of my assistants goes through the catalog file and a card index which we keep of new or improved features shown in advertisements, and we invite in the representatives of the houses that have any show of selling us.

"Others, of course, come too when they hear it rumored that we are in the market for equipment; but, unless they have something to point out that we have overlooked—and, naturally, we are always willing to hear about that—I send them on their way again in a few minutes

"There are ways of doing that pleasantly, you know. They all realize now, however, that we don't just let things 'leak out' like we used to do when we were making up our minds what to buy or whether to buy at all, but that the trade will be notified when we are actually in the market and everyone given a fair show."

* * *

Only reliable products can be continuously advertised.

Methods in a Gasoline Engine Shop

By F. A. Stanley

Boring and facing cylinders in an Iowa factory by means of special tools in the upright driller and horizontal machine. A pair of facing and chamfering cutter heads fitted with roller guides in place of the usual pilot.

Two convenient hoisting arrangements for lifting engine frames and flywheels.

Drilling light work and grinding belt pulleys.

The Waterloo Gasoline Engine Co., of Waterloo, Iowa, makes use in its plant of a great many interesting tools and methods, a number of which will be illustrated and described in this article.

One of the best general views in this plant is reproduced in Fig. 1, which shows a row of Rockford drillers equipped for boring cylinders of gasoline engines of various sizes up to four horsepower. In the foreground will be seen a large number of these engine frames with the cylinders cast in place. A better view of the whole casting and the tools employed in the boring operation will be obtained from Fig. 2.

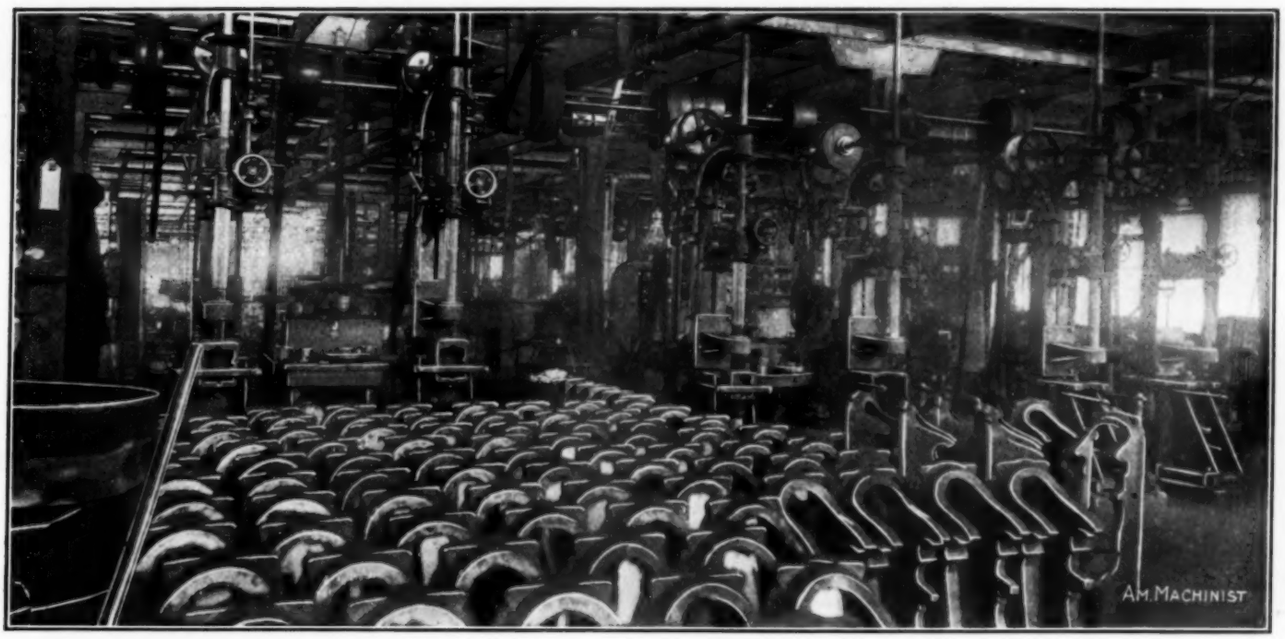


FIG. 1. A ROW OF MACHINES EQUIPPED FOR BORING GASOLINE-ENGINE CYLINDERS

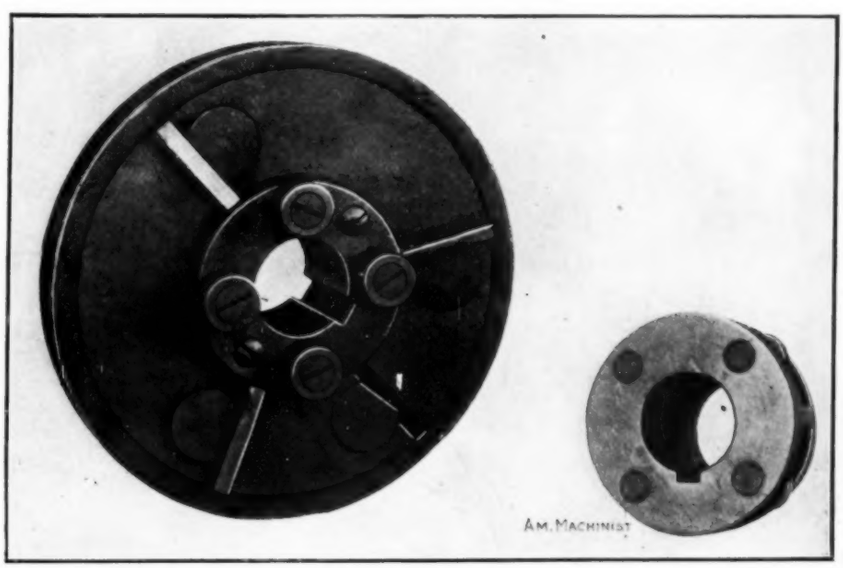


FIG. 3. CUTTER HEADS FOR FACING AND CHAMFERING CYLINDER ENDS

CYLINDER-BORING TOOLS

The latter illustration shows two of the upright machines with the holding fixtures for the engine frames, in position under the spindles, and with the complete outfit of boring and facing tools either in actual use or upon the bench between the machines.

As will be noticed, the fixture for holding the work is an open casting, flanged at the bottom and strapped to the base of the machine. Stop screws at the top, and an adjustable equalizing device at the bottom, center the work sidewise in the fixture, and in conjunction with a swinging strap near the upper end, hold the casting firmly in place for the boring and facing operations.

The first boring tool is a spiral, inserted-tooth head. A boring cutter of this kind is shown in operation in the machine to the right and another will be seen resting on the stand. The finishing cut is taken with a reamer head with straight inserted blades, a tool which is shown at work in the cylinder under the machine at the left.

THE FACING CUTTERS

An important part of the cylinder tool equipment is two heads with roller guides, which are used for facing the outer end of the cylinder and for chamfering the inner end to produce a clean-finished, well-rounded corner at the cylinder mouth. Although these heads are visible in Fig. 2, their construction is more clearly shown in Fig. 3.

Referring to Fig. 3, it will be seen that the large facing head carries at the outer

end of the hub a set of four narrow rolls. These are located at such a radius from the center, and are of such diameter as to fit nicely in the finished bore of the cylinder and provide a smoothly running guide for the cutter head, thus obviating the possibility of chatter, and at the same time avoiding all danger of injuring the smooth surface of the bore.

The cutter head carries three facing blades, which are held in place by side-binding plugs drawn back by nuts at the rear. It is provided with a keyway, which fits over a key fixed in the spindle, and like the other tools used on this work, it is readily slipped into place and as easily removed when its operation is completed.

The smaller facing head in Fig. 3, for the inner end of the cylinder, operates on the back-facing principle, and is slipped onto the spindle after the latter has been run down through the bore of the cylinder. It carries one tool only, which is secured from the rear. The piloting rolls in this case are carried on studs passing through the double wall of the head. The edges of the rolls will be seen projecting from the openings formed between the front and rear wall.

Handling Larger Work

Cylinders of the larger engines are bored on Barrett horizontal machines, one of which is shown in Fig. 4, with an engine bed in position and with the cutter head in operation in the cylinder. The fixture for holding the work and the means of securing it in place require no description.

Attention may, however, be called to the handy hoist arrangement for lifting castings into and out of the borer fixture. There are, in fact, two of the borers, on opposite sides of the aisle, and one hoist and trolley serve both machines.

The overhead arrangement consists of a pair of fixed I-beams, extending over

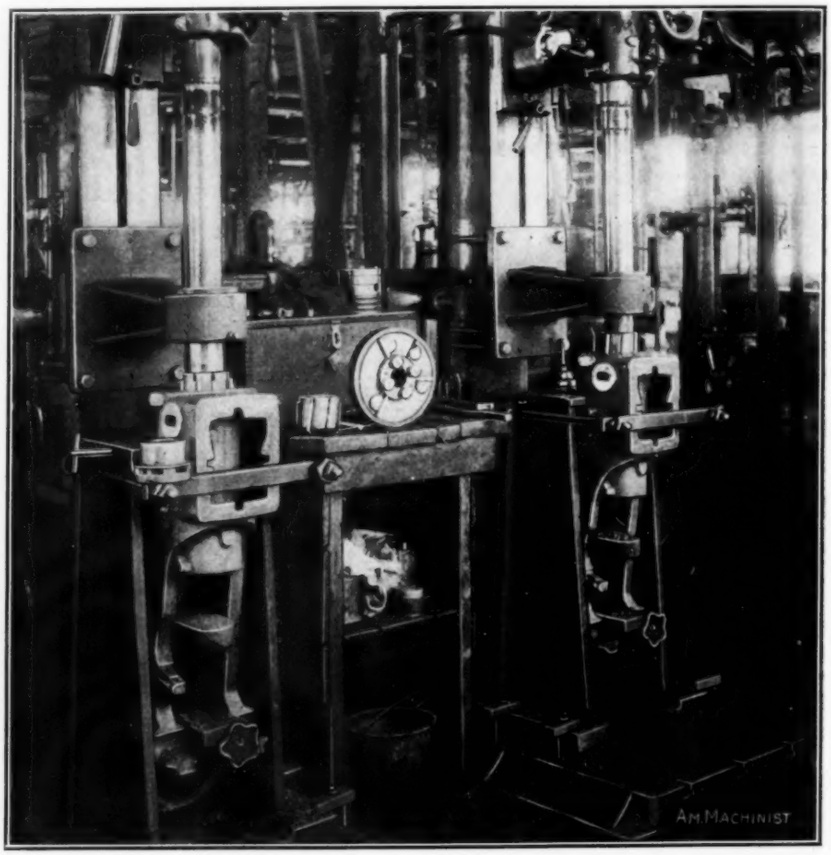


Fig. 2. Cylinder Boring Tools

Fig. 4. Boring Cylinders on the Horizontal Machine

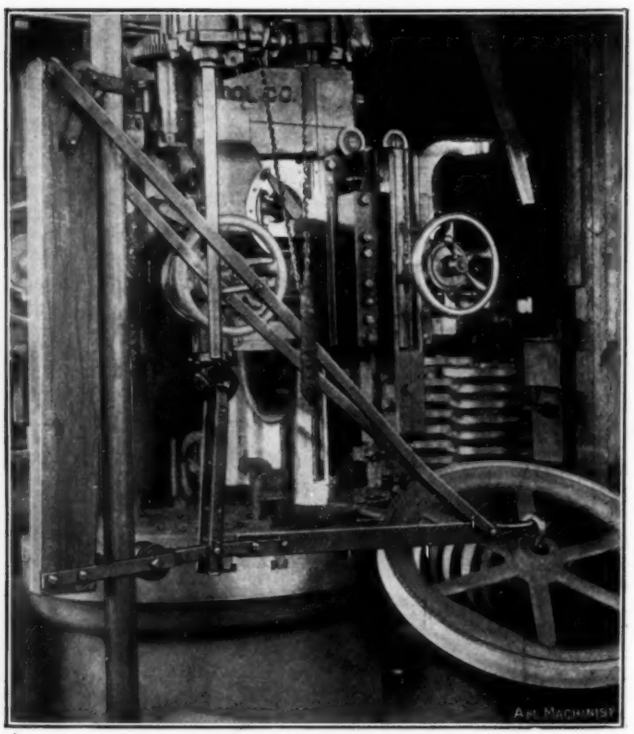


Fig. 5. Hoist for Flywheels

both borers, beneath which a framework of two lighter I-beams is carried by two trolleys running on the main beams. This traveling frame carries a horizontal air hoist at one end while a pulley block for the chain from the hoist is suspended at the other end. The carrier for the hoist is slid in either direction to bring the hook over the desired point, and when the hoisting rig swings freely about the vertical post, the operator can handle the flywheel with ease.

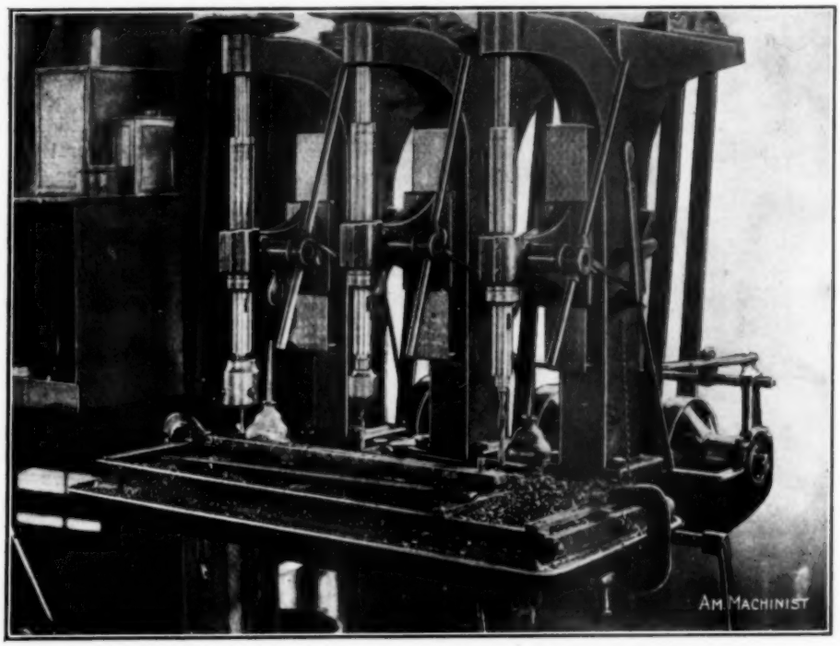


FIG. 6. SKELETON TABLE FOR SENSITIVE DRILLING MACHINE

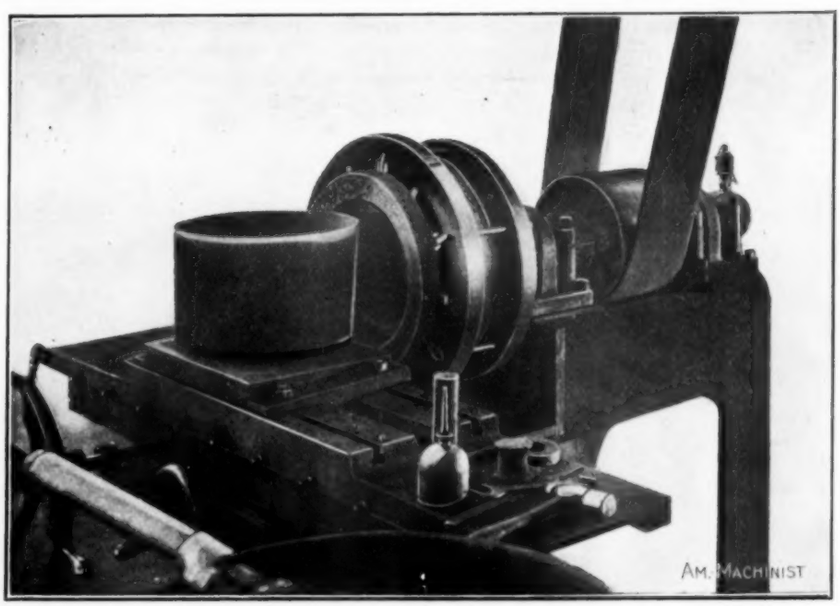


FIG. 7. METHOD OF GRINDING PULLEYS

air is applied, horizontal movement of the piston gives a vertical movement to the hook and work.

A FLYWHEEL HOIST

Another convenient appliance for handling work is illustrated in Fig. 5. This represents a method of lifting flywheels onto and off the table of a Colburn vertical mill, the wheel being picked up and shifted in a horizontal position, so that there is no danger of its striking the tools and drivers and no difficulty in placing it directly upon the machine table or flat upon the floor after it is machined.

At the side of the machine a small vertical column is placed, upon which a light but strong jib crane is carried with an overhead air hoist hooked to the lower member of the crane. The outer end of this member is slightly hooked to engage with a hook bolt slipped through the pulley hub. The work is thus suspended in such manner that it hangs practically in a horizontal position, and as the whole

AN AUXILIARY DRILLER TABLE

One of the common difficulties encountered in drilling small parts in quantities, particularly where the work is of steel, and oil is used, is the tendency for chips and grease to lodge under the work or in the jig. Especially is this the case where the work is of considerable length or width. Often when only a few small holes are to be drilled in each piece, the time and effort expended in keeping the work flat on the table are greater than that required in the actual drilling operation. Fig. 6 shows the means adopted in this shop to overcome the difficulty.

The machine is an Allen three-spindle driller with a large table, upon which an auxiliary table of skeleton form is secured by clamps at each end. This framework is about 1½ in. deep with ties across the top directly under the spindles, and upon these cross members the piece to be drilled is placed. The work is a "side rod," a narrow strip of steel with a 3/4-in. hole in one end, a 37/64-in. hole at the other and a smaller hole in the edge. The last two holes are tapped in a later operation in the same machine.

A simple drill jig is used for this piece, and as soon as the 3/4-in. hole is drilled, a plug is inserted through the jig bushing and the work, to assure fixed location for the other holes. As the work rests only on the crossbars of the frame, there is no difficulty in keeping the resting spots clean, and the chips may accumulate to a considerable extent in the openings between without interfering with the drilling process.

GRINDING PULLEYS

A method of grinding pulleys from the rough, after the hub has been bored to size, is shown in Fig. 7. A fixture with a fixed stud to fit nicely in the pulley bore is fastened to the table of a face grinder, and the table is secured in such position that the contact of the wheel with the pulley is at one side of the center and along a curved line at something of an angle with the axis of the work; the relative positions of the work and the grinding wheel enabling the wheel to rotate the pulley slowly at the same time that it is rapidly grinding the surface.

The peculiar nature of the contact between the wheel and the work produces a crowned pulley, the upper half of which is ground first, after which the work is turned over on its stud for the grinding of the other half.

D. C. Buell, chief of the educational bureau of the Illinois Central, has issued a circular to employees announcing that the bureau is now in a position to assist employees in legal matters to a certain extent.

Scientific Spirit in Management

By William C. Redfield*

If a science were ever needed it is in this very matter of management.

Elements in all that has been proposed are: Close co-operation and sympathy between the management and the workman. This is foremost and basic.

Standardizing of equipment and tools.

Systematizing of work in operation; care, maintenance and issue of material and tools; careful routing of orders.

Planning the work in advance for each machine.

Study of the actual time occupied for each element or movement in the work.

Determination of proper time allowances for rest and delays.

Fixing standard time for doing work based upon the aforesaid studies.

Payment of the workmen based upon the work done and its relation to the standard time.

As one looks at our industries, a curious inequality of standards appears. Much of the work is on a real scientific basis. The application of mechanical, metallurgical and kindred sciences to industrial practice has been general. A science of costs is growing up and is developing a literature. The art of testing materials and of adapting them to special uses is widely applied. The science of accounting is well developed. But there has not yet been established a science of management.

And yet, if a science were ever needed, meaning definite rules or principles, based on exact knowledge of facts, it is in this very matter of management. For very clearly present guesswork or rule-of-thumb methods have, in many respects failed. Industrial war is common, labor difficulties are frequent, in many quarters waste prevails. Manufacturers complain of the inefficiency of their working forces and of the narrowness of profits.

There is no uniformity in principles of management, even in the same industry. It is not proposed, nor is it desirable, to diminish the initiative of factory managers, but the study of mechanical science has helped, not hindered the individuality of the mechanic, and a manager would be aided rather than restrained were the broad principles of the science of managing developed so as to find general acceptance.

What is called "scientific management" aims to learn the facts concerning factory production in all its varied phases and to base upon the results of such study a practical system of industrial operation. To this end it inquires minutely into all the small details of shop operation, and attempts to lay down principles of general application.

In considering the value of any science, the principles on which this newcomer is based must be fully and justly weighed in forming a judgment about it that is sound. It will not do to pick out a particular phase here and there, and without relating it to the whole of which it forms a part, criticize it as if it stood alone. Nor will it do to carp and cry at some one statement as if it, and it alone, were final and complete. Scientific management has suffered from this sort of attack which serves, however, chiefly to show that the facts concerning it are not fully known or understood.

Elements of Management

Disclaiming attachment to any particular system or exponent of efficiency, these elements seem to be clear in all that is proposed: Close coöperation and sympathy between the management and the workmen. This is foremost and basic. If it is not realized that this is foremost and basic, the subject is completely misunderstood.

The standardization of equipment and tools throughout a shop.

The systematizing work in operation, of the care, maintenance and issue of material and tools, and the careful routing of all orders while passing through the works.

The planning in advance of the work for each machine and furnishing tools, fixtures and materials ready to the hand of the workman before needed, so that delays between operations are cut out.

The study in many ways—sometimes by stop watch—of the actual time occupied by each element or movement of every operation, in order to determine the time required for any operation and to save waste energy.

The determination of the proper allowance in time study for rest, necessary delays or interruptions of work.

The fixing of standard time for doing work, based upon the aforesaid studies, and the careful personal instruction of workmen in the best and easiest methods of working.

The payment to the workman usually of a bonus or premium, based upon his doing the work in a certain relation to the standard time. It is common to arrange for an increased pay of from 35 to 50 per cent., based upon a saving of time.

The above analysis is not, and is not meant to be, exact. It is a general statement in popular language of the broad facts. Any system must be flexible, must provide for the local conditions existing in each shop, and must suit itself to them. The spirit of the whole thing is co-operation. Where this is absent, there is not present what is called scientific management. All the blanks and forms and rules in the world will not make good the want of the spirit of mutual helpfulness, which is fundamental.

And contrariwise, where the spirit of sympathy and coöperation is active in a shop, there scientific management is present in its essential form, even if the rules and methods for the present go little further. It may be said, and truly, that in the suggested principles there is little or nothing new. This is admitted by the advocates of the new methods. But the grouping of these into a whole, with definite relations and establishing them all on a basis of mutual good will, is still so new as to be unfamiliar even to many progressive men, and is still outside the knowledge of some critics.

It is my conviction that it is contrary to the very spirit of efficiency to establish any system of the kind by fiat upon an unwilling or even upon an uninformed working force. One improvement takes place, let us say, in a stockroom, then a change in routing is made; a shift of machines follows, and so on. In a large works it may take, indeed should take, several years at least to get it all in operation, even if in its entirety it is ever anywhere used alike. Probably the result will be that progressive managers will adopt features here and there from the various systems, will fit them to the methods already used and let the whole thing develop normally.

This is the proper and sensible way. The chief thing is to get the spirit of mutual confidence and support in control, and then it is not so very material what form the movements to follow take.

But one thing must, by common consent, be speedily done. The waste of time, materials and efforts in our shops must be stopped. The friction arising between employers and workmen, often from trivial causes and misunderstandings, must, in the interests of all, be

*Mr. Redfield is a member of the 62d Congress from the Fifth District, New York, and has been a member of the Special Committee of the House of Representatives appointed to investigate the Taylor and other systems of shop management. This committee report was published in Vol. 36, page 473.

Further, Mr. Redfield has long been prominent in the machinery manufacturing field and is at present vice-president of the American Blower Co.—Editor.

done away. Efficiency is necessary to keep our product and wages up and our costs and prices down.

Whatever, in a spirit of candid helpfulness, tends to advance wages and product under just and equitable conditions should and will have a fair trial. The good in it will be retained, the evil, if any, rejected, and the world will have moved another step forward.

The Progressive Spirit

Not long ago, I stood with a factory manager of 30 years' experience in the shop of which he has charge. It was a prosperous shop. Evidences of intelligent work were on every hand. But the manager was not content. He had spent years studying his own work and had made changes here and filled in weak spots there. His costs were going down and his output going up, but he was not satisfied. He took me about to show that this machine must make way for one better suited to the present work, that these must be shifted to give space for free movement, and that the heavy tools must be moved to save handling materials.

Here a new place was made for "laying out"; here tools brought nearer to the point of use; here a new machine or fixture was being tried; here a better design of output was being made. Everywhere his searching eyes looked to see what could be bettered. He was under no illusions. No false pride in his own works blinded him. He was not controlled by what others were doing, nor following traditions. His keen professional mind was at work probing his own weaknesses. The owners and customers of that factory are in safe hands.

A great export movement has, within a few years, altered the face of American commerce. Our exports of manufactures in 1911 were fivefold those of 1891, and formed nearly one-half (45 per cent.) of all our sales abroad. We have been accustomed to think of ourselves as feeding a large part of the world, but our foreign sales of food stuffs are now but a small proportion of our exports. Nor are the products of our industries sold in the world's markets confined to a few classes of articles.

American elevators are running in Punta Arenas, on the Straits of Magellon; American engines in Iquitos, on the upper reaches of the Amazon; a hotel in Buenos Aires is built of American structural steel; American glassware goes to Germany; American desks to London; bridges in Burma, India, came from Pennsylvania; the locomotives in Japan from New York, and the ginning machinery on the Russian Czar's cotton plantations in Turkestan was made in Texas.

Our export sales, however, are merely "the outward and visible sign of an inward" industrial growth. They are the result of progress toward that industrial freedom arising from self-help, which contains the solution of many of our social and labor problems. Even a hasty glance over the industrial field shows that those of our industries that have succeeded in the world's arena are also those that on the whole pay high average wages, and whose operatives work under the best conditions for health and for large output.

Conversely it will appear on study that the industries which do the least in the foreign field include those paying the lowest relative wages, and whose working force often operate under less favorable conditions of equipment and sanitation.

Cost of Production and Wages

In the hearings before the Congressional Committee of the 62d Congress on Scientific Management in the government industries, two striking things took place. One was the testimony under oath of experienced manufacturers in different lines that the cost of production was cheapest where men were highly paid and provided with the best tools and working conditions. The other was the consistent testimony of trained students of industries that keen self-criticism was at once the first duty and the most profitable privilege of every manufacturer.

Within these calm and conservative statements made in the quiet of a committee room at the New York Chamber of Commerce lies the germ of a social and industrial revolution. If American manufacturers grasp and act upon the truth to which their fellows have sworn, the results upon them, upon their workmen and upon all consumers can hardly be measured. It means more profit for the first, higher wages with less effort in fewer hours for the second, and lower prices for the third.

During many years, at the request of my partner, I spent some time daily in his factory, with the direct management of which he had little to do. He searched about to find what was wrong, what could be improved, how things could go with less friction, how waste of time and materials and machinery and labor could be saved. He was there to criticize everything, no matter how time-honored or customary it might be. There was not a day when this self-study did not develop something of value.

In this shop the men were paid wages several times greater than those in European industries of the same kind, but since the men knew their rates would not be cut when they earned largely, they did not fear to turn out such a product in quality and quantity as to make it possible to sell it in Europe against the handicap of the continental tariffs. Certain serious elements of loss, such as defective goods (seconds) and stoppages for repairs, in time almost disappeared.

It is strange that a people of such energy and resourcefulness as we are should have been so long content to think ourselves unable to compete on even terms with others, and should have held so long to the superficial and worn-out theory that the rate of wage we pay was the chief and controlling element in the cost of our goods, making them so expensive that they could not be sold at a profit against the makers of Europe on even terms in our own country, much less in Europe itself.

But strongly as some of our industries still insist that their low wages must go still lower if they are to meet Europe on an equal basis of cost, other manufacturers have learned better. From West Virginia, a concern making glassware writes that its largest sales are in London and Germany, and it finds it wise to pay higher wages to produce goods for those competing markets.

In the same industry another company runs on such a basis that recently one of its workmen was earning $11 per day; another earned but $8 daily. What was the attitude of the management toward these men and their wages? Was it that if the man earning $11 could be made to turn out the same product for half that sum the concern would profit thereby? Hardly! The course taken was to retain an efficiency engineer to show the manager how the product of the $8 man could be so increased by instruction and by creating right conditions that he could, without overstrain, bring his productiveness up to a point where he also would receive $11 daily.

This manufacturer had grasped the truth that close and sympathetic cooperation between his men and himself was profitable to both, and that a wise regard for his cost sheets, and an enlightened selfishness, both warned him that the policy of crowding the workmen to the largest product at the lowest wages did not pay.

In one of our industrial states are mills that say they cannot obtain efficient woman workers. The wages paid to women by them average not over $6.50 weekly. They would like to do an export business, but they say their cost of production does not permit, and they have shut down more than once for lack of a profitable market at home. In the same state is a manufacturing company which takes special pride in its working girls, shows pictures of them grouped about the mills in its advertisements, pays them an average of $10 weekly, and sells its goods in fifty countries.

In the first concern the management is traditional. It has gone on undisturbed in principle and practice that are really ancient history, and the nonresident owners know the management is sound and wise for their dividends are regular. In the second concern the presence and

power is felt of an owner who is his own severest critic, who, so to speak, stands beside his methods and rigorously studies them, whose thought is not: "I am sure I am right," but rather the question: "Where am I wrong?" He recognizes that the basis of low cost of production is righteous wages and liberal treatment, and finds both lucrative.

Industrial Managers

Our industrial managers are divided into two camps, the fearless and the fearful, those who face the light and those who look to the past, those with open and those with closed minds, those who think they know and those who seek to know. The testimony before the Congressional Committee brought out distinctly also the fact that the effort for a keen study of factory conditions and toward a higher wage, based upon a greater product more easily made and made more cheaply, meets its greatest resistance from the owners and managers of mills who call themselves conservative.

One is curious to know what men think they conserve when they say, as some do, that they can only face greater competition by reducing the wages of employees already paid an average of $8.50 weekly. Indeed, so "left to themselves" are some manufacturers of this type that one of them deliberately worked his operatives into a position where they could not resist a cut in their wages, and when the foolish manager ordered the cut made, he said to his deluded self that he had saved $65,000 per year by it.

Another specimen of this same sort stated that on one article he had cut his piecework rate five times. He not only thought this wise, but said his workmen had done him wrong because they had not at the former higher rates turned out as large a product as that which necessity drove them to make when the rate was cut. Under management of this kind conditions often exist where indirect losses occur many times greater than the supposed saving in the payroll arising from a cut in wages. But to these losses such managers are blind.

It was stated in October last at the Dartmouth Conference on Scientific Management that in one large mill the waste of money through blind management was such that a saving of $1000 daily was possible, without touching wages, by the use of well known and established methods. But the managers were so wedded to their own ways and knew their own business so well that the opportunity to make these economies was refused.

It seems incredible that this should be so, but there is no question either of the facts or of the further fact that this is a common attitude of mind and causes no surprise to those familiar with the situation. There are owners who flatly refuse to believe that they can be taught anything of serious value about the management of their own plants.

In one large establishment a specialist was employed to devise economical methods. He did so, and in due time presented this report to the managing officer. That report struck directly at the methods and ways of that officer, and made him very angry. He said he had retained the expert to show him how to work his men, but was instead told how he himself should work, and for such a lesson he thought he had no need and he would not take the trouble to find out.

It is a natural thing that a man who has from small beginnings developed a large plant into profitable operation should be not only pleased with his own success, but feel confidence in his methods. Yet there is no more pernicious industrial fallacy than this, for the very fact that the plant he operates is his own, and that his interest in it is so intimate, blinds him often to defects. One of his competitors may develop on different lines but he too has the weakness that arises from the limited horizon visible from his own personal point of view.

Outside of either concern a student of that industry having no personal interest in it, and being only an impartial and unselfish seeker for truth will often find, by thoughtful study, weaknesses common to both plants and some strong points existing in one and not in the other. I recall two shops making similar goods that ran on opposite methods. One put two machines to one man and ran them slowly. The other put two men to one machine and ran it rapidly. Both succeeded, but one much more so than the other. Possibly neither was wholly right.

It is an obvious and well worn reply to those who urge upon manufacturers that their foremost duty to themselves, their operatives and the public is self-criticism and self-help, that competition insures this, that when a producer is undersold he needs no further spur to make him study his methods and improve them. This is a theory containing much truth, and it is the putting of it into deeds that is now advocated.

The Value of Self-Criticism

In company with a friend of wide experience in such matters I visited a large establishment in the East whose proprietor took pride in his extensive plant, and, indeed, with just cause, for many conditions there were ideal. There was fine light and abounding fresh air, and skillful arrangement of fine machinery. Yet a large part of the productive portion of the plant was on the average producing but two-thirds of its capacity, and the labor cost in the product was very much more than that of other concerns in similar lines.

Our host was in many ways as thorough as he was courteous, but he was controlled by the belief in himself natural to a strong man, and impressed upon us again and again the fact that he "knew his own business." Yet work went on by hand which was elsewhere done by machinery, and expense was put on some operations that a man who was a thorough self-critic would have found means to save.

Into the office of a large factory in New York state went one day a competitor of the concern who thought it courteous to call upon his rival. He was cordially received by the quiet and unassuming owner, and finding the atmosphere congenial, began to talk on matters of mutual concern. Being asked whether he had not secured a certain order, he answered in the affirmative, saying that it was a specialty with him and that he had been able to reduce the cost for material and labor to about 18 cents each piece. His host said that he had not himself given any special study to that particular article, and that he was very glad to have suggestions.

When the visitor left, the owner crossed the room to his costkeeper whose eye he had seen twinkling and asked him what the last lot of those goods cost for labor and material, and was told six cents each. The trouble with the visitor was that he had no realizing sense of his own heavy burden charges, and ignoring them and forgetting selling cost he had underbid the man whose actual outlay was but one-third his own. This is but one of many possible illustrations that the man who "knows his own business" is often ill informed about important factors in it.

How many take the attitude of a successful engineer who said: "If I don't know why I know what I know, then I want to know," or that of a friend in Rotterdam, the successful manager of a large business who has over his desk a card on which he has written these words: "Every man I meet is my master in something, and in this I learn of him."

Whenever one meets industrial managers who are sure of their own knowledge and wisdom, and there are such true industrial Bourbons in our country, who roll the word "conservative" under their tongues with sweet self-satisfaction, one has that sinking feeling common to those who try to enlighten hopeless ignorance. The really wise are not so sure of themselves.

Many years ago I was taken by my uncle to visit his friend Prof. Asa Gray, the great botanist, at his home in Cambridge, Mass. Prof. Gray was then at the height of his fame. I sat through the evening impressed with the deference shown by others to the judgment and knowledge of Dr. Gray, and with the latter's quiet modesty. As we came away, in a burst of boyish enthusiasm I said: "Oh, Prof. Gray, I wish I knew as much as you do." I remember his putting his hand upon my shoulder and calling

me by name, saying: "I have learned that I know very little." It is a lesson that can be taken to heart by many in our industries.

Danger of Traditional Practice

Some years ago I took an order from a large English bicycle factory for a lot of forgings to be made in America and sent to England for machining. When the details of the order had been taken down the buyer was asked what allowance for finish should be left upon each surface. He said ⅛ in. Thinking of the fine plant of special American machinery that the English manufacturer had installed and of what American custom was in the use of such machinery, one felt sure the man had made a mistake. I said to him: "So much as that? Our rule is to allow 1/32 in. and in some cases as little as 1/64 in"

The customer was annoyed. He said that he wished to be serious, and intimated that it was no use to attempt to make Yankee yarns go down, or words to that effect. I had to yield, with the result that the English manufacturer not only paid for a lot of metal for which he had no use, but did in his own shop four times the amount of work that was necessary with the normal result of that waste upon his output.

Yet there is no doubt that our English friend could have made out on the surface a good case for himself. Was he not in actual operation of a large and successful business doing just this very work? Had the years and study he had devoted to his own trade gone for nothing? Why should he, running a shop in England and familiar with the best practice there, take the statement of an American salesman as to the custom in another country, merely because he happened to be using American tools for certain work?

The conservative has always a case. He is the man who talks about dealing with facts and not with promises. He is always practical, not theoretical. He is always sure that while one or another course may be satisfactory in other places, it is not suited to his business. I doubt if there is any more wornout excuse than this just mentioned of something which has worked elsewhere not being suited to this or that or the other particular business.

There are, of course, limitations that must in fairness be admitted. A factory manager is a busy man. From dawn to dark problems large and small press on his thought. Questions of policy, of principle, of practice, of purchase in every form crowd his hours. Amid these cares he often, while doing his best, is conscious that there are better ways, but having only one man's strength he cannot take them up, especially if he has owners above him who are content with anything so long as it pays. The greater need, therefore, for defining the true principles of management.

It is not strange, furthermore, that men should insist on following well worn ways when one discovers how little some really know about the business in which they are engaged. When I entered the employ as a young man of a manufacturer in New York City to do the bookkeeping, I was strictly forbidden to make a monthly trial balance from his ledger; in other words, I was required not to balance his books. It was, of course, unsafe to keep his accounts in any such way, and, therefore, I took monthly the proper balances that I might know and show, if need be, the accounts to be correct, but I never ventured to let my employer know that his books were thus in order.

Some years later I was employed as an accountant by a firm which ran a large foundry. After some months I pointed out to my employer that apparatus he was selling at $8000 was in fact costing him $9000. He was very angry and when I tried to show him that the cost was correctly kept, he told me I was "arrogant," and in substance that I should know better than to attempt after a few months' experience in his office to tell him what his goods cost, a matter about which he who had been in business 30 years was far better informed than I could possibly be. Nonetheless it was true. Within a very few years the concern wound up.

It is within a year that the proprietor of a large mill in answer to my question where he kept his costs told me "in my head," and went on to say that he had thought of putting in a modern cost-keeping system, that he supposed it was possible to learn what each operation in his large plant was costing, but that it would involve an outlay of some thousands of dollars, and that he had never gotten to it yet.

One of the officers of an association comprising many of our largest manufacturers told me a short time ago that "within the last few years" many of the manufacturers represented in his association had begun the keeping of costs. Yet the most superficial knowledge of how the cost of goods varies in different factories making similar products should set men searching and studying their own ways. Wood pulp varies in labor cost from 98 cents per ton to $5.90 per ton, and the cost of turning 36-in. coach wheels varies fivefold in different railway repair shops.

Rule-of-Thumb Methods Must Go

What is the conclusion of the matter? Methods based on guesswork or on rule-of-thumb must pass away. They are not always or even usually coincident with success. They account for much if not most industrial failures. But where success exists in spite of them they are too often hugged to the breast as "our ways of doing," and their vicious nature is unstudied and unknown.

Manufacturing has now become a profession and must be approached in the same professional spirit with which a physician or a lawyer carries on his work. It is the man of open, yet balanced mind who will win. No methods are good merely because they are in use. No equipment is the best possible because it is what others use. The custom of the trade may be, and often is, a bad custom.

The manufacturer today must not only know but know why he knows. He must learn to distinguish the man with vision from the visionary, not only to see the things which are but to deduce from them those things that ought and are to be. His final proof must no longer be "It pays." No longer can a manager say to himself when he buys a machine: "This is an investment," and when he hires a man: "This is an expense."

The industrial manager of today must take a different attitude toward labor than that which has been common in the past. The day when the largest output was asked for the smallest wage is passing, not to return, for that theory of production is being proved false and expensive. It has been coincident with such waste, in other ways, and provocative of such expense in many forms that with increasing knowledge it has been outgrown and is being discarded.

The keen and careful manager of a modern plant will rather follow the law of the greatest output and the greatest wage. His thought will go to the reduction of his burden charges, to removing the costs for repairs, to keeping his producing machines moving through the largest possible percentage of the working day, to stopping the production of "seconds," to providing the uninterrupted flow of material, to cutting out the waste of time, and in these productive ways he will find his time so profitably and so intensely occupied that the payroll may be forgotten, save that he will, to the extent that he is wise, see that it is commensurate with the productiveness of his operatives. We may even hope that ere long he will come to say with true pride: We pay the largest wages, and we have, therefore, the lowest labor cost."

A new electric bicycle lamp has been introduced in Amsterdam, for which electricity is generated by the operation of the bicycle. A small wheel attached to the shaft of the dynamo rests on the front or rear wheel of the bicycle, making many revolutions for each one made by the larger wheel. When the lamp is not needed, the little wheel can be set free from the bicycle wheel by a lever. A very powerful light is obtained at a speed of 15 kilometers (9.32 miles) an hour, but sufficient light is obtained at even less speed.

Manufacturing on Precision Machines

Special Correspondence

A variety of turning and grinding operations done on the precision lathe not ordinarily linked with that class of equipment.

Some unusual milling operations.

We are too apt to confuse precision lathes with the small lathes of watch makers which we see mounted on a pedestal under the headstock. As a consequence wo do not appreciate the amount of work which can be done by them.

A few examples of the rigidity of a good precision lathe, and the way in which it is used in regular manufacturing will, we believe, call attention to some of its possibilities in finer machine work.

While Fig. 1 is hardly a manufacturing operation, it is an extremely interesting test of the rigidity of almost any lathe. If anyone doubts this let him take a piece of ¾-in. bar stock, and grip it in a draw-in chuck as shown, allowing the end to project two or three inches. Then take any kind of a cutting tool and set it so as to reduce the stock at one cut, from the full diameter to the needle-like core shown, and see what happens.

As can be seen, the bar has been turned back for over an inch, leaving the slender center or core intact, which would not be possible if there was any lack of rigidity on the part of the lathe spindle. Any spring which would allow it to lift appreciably under the cut would destroy the core. The chips show the kind of a tool used.

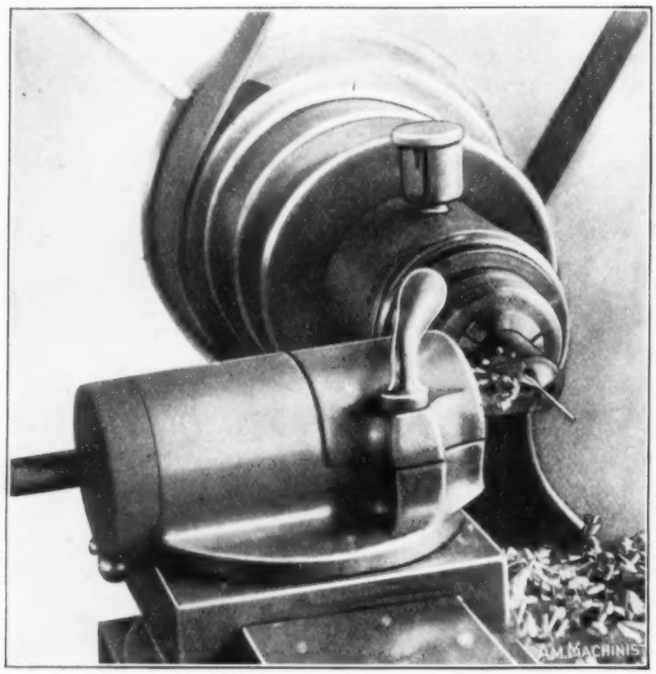


FIG. 1. A TEST OF RIGIDITY

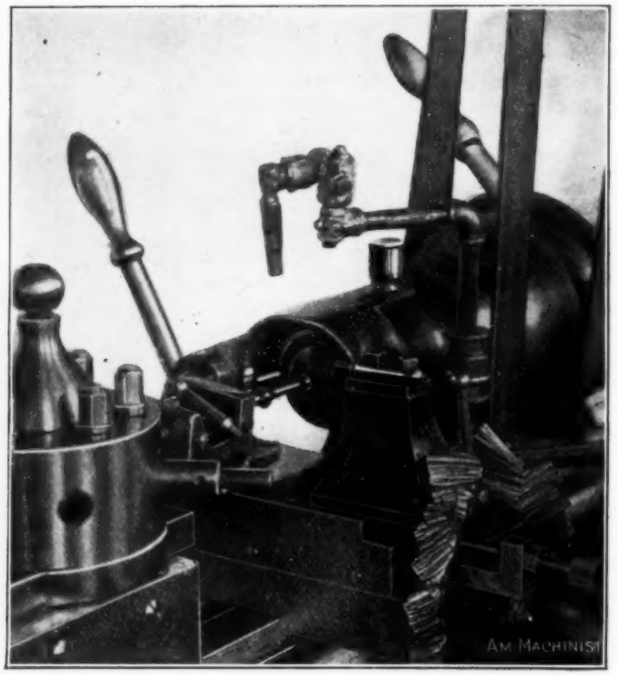


FIG. 2. FORMING FROM THE BAR

FORMING FROM THE BAR

Another test of rigidity is shown in Fig. 2, where one of these lathes is equipped for manufacturing, being fitted with a turret and cross slide. The work being done is the turning of the small handle shown, the end being turned down with the box tool, and the handle being formed by a circular cutter held in the front of the cross slide.

Although it is not possible to clearly see the forming tool itself, owing to the piece of work being turned, it produces the whole length of the handle at one cut, as can be seen by some of the shavings at the back of the cross slide.

When the width of this cut is considered, it will be seen that a very rigid

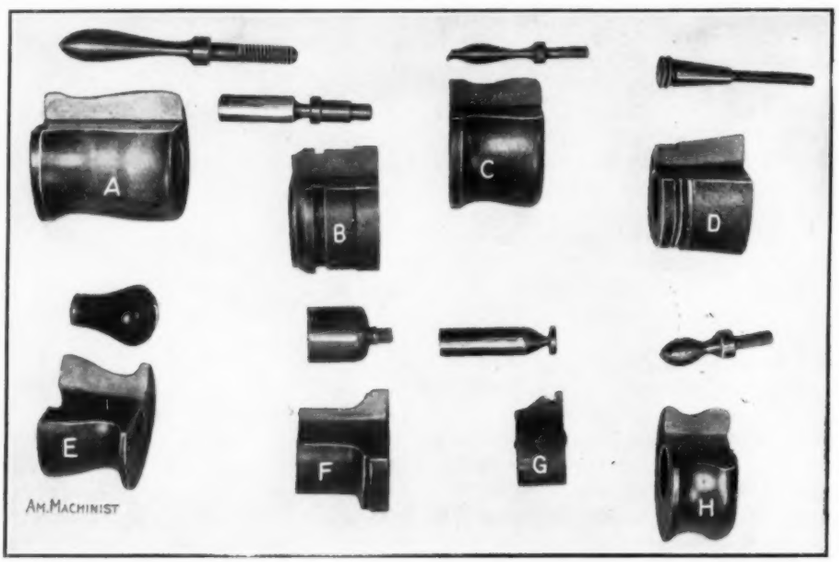


FIG. 3. CIRCULAR FORMING TOOLS AND WORK

lathe is absolutely necessary in order to avoid chatter, and the handles being made were singularly free from this too common defect.

In Fig. 3 is shown a number of forming cutters used on this lathe together with the work produced. As the reproduction is about half size it will readily be seen that a lathe of this kind is capable of producing quite a variety of work, and that it is not confined to small sizes. These pieces are mostly of machine steel, although the small handle *E* is of hard rubber, and the oil cup *F* of brass, the exact nature of the material not being particularly important.

Grinding Worm and Cutting Wormwheel

Another and entirely different use of the lathe is shown in Figs, 4 and 5. Here the grinding head is being used in the tool-holder for grinding the worm on the hardened-steel shaft shown in place in the lathe. The grinding wheel has been swung to the angle necessary to fit the angle of the thread.

The form of holder allows the whole grinding spindle to be swung at any desired angle, and as the base of the holder can also be turned on the slide, it gives a combination which allows any angle to be secured. In this particular case the wheel is being used to grind the sides of the threads of the worm after it has been hardened, so as to remove the spring, and have the worm drive perfectly true.

After the worm has been properly finished, the wormwheel, shown in Fig. 5 is mounted on the wormshaft and is being cut with relation to the wormshaft on which it runs. This makes a very accurate method for doing work of this kind, as the worm threads are first ground with relation to the axis of the wormshaft after it is hardened. By then mounting the wormwheel on this, and cutting its teeth, the latter is sure to be

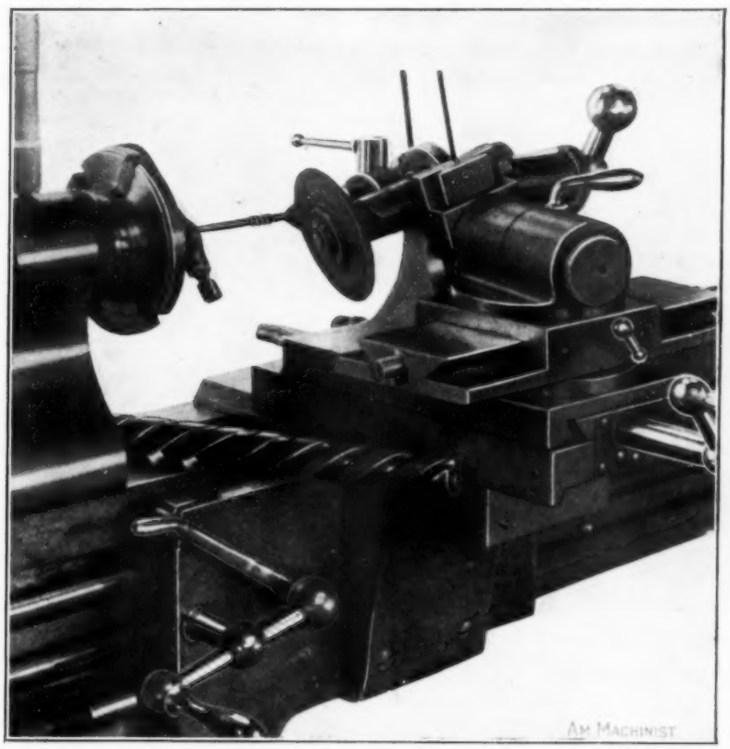


Fig. 4. Grinding a Worm in the Lathe

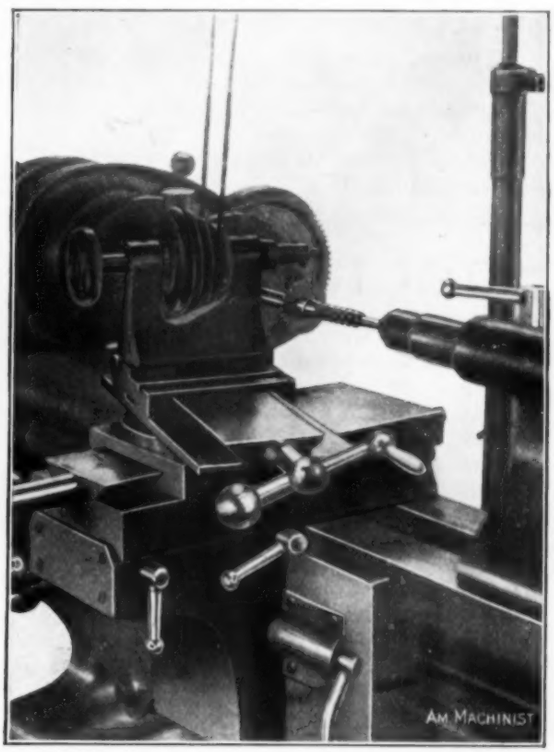


Fig. 5. Cutting the Worm Wheel

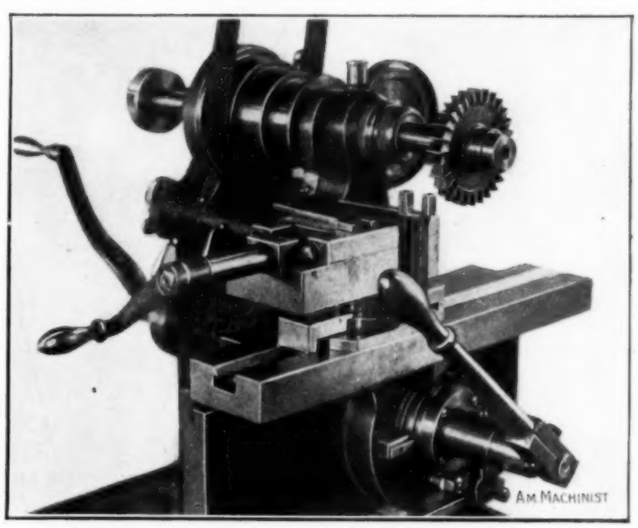


Fig. 6. Milling Fork with 4-in. Cutter

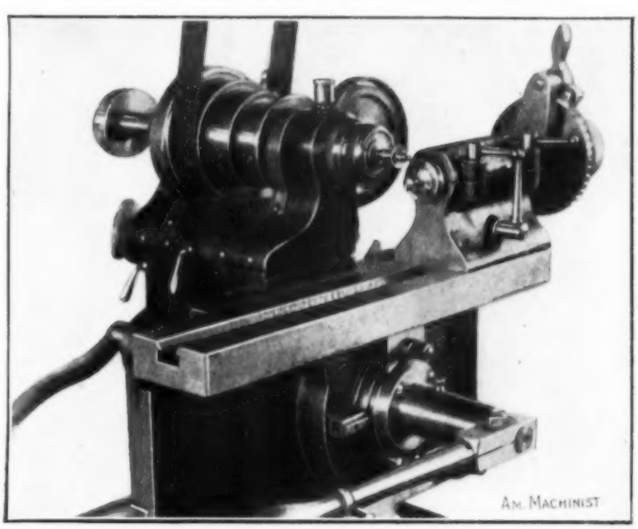


Fig. 7. Cutter Only Three Thousandths Thick

true with the axis of the shaft with which it revolves.

The wormwheel is cut with the fly cutter shown, this being driven by the same belt which drives the grinding spindle as shown in Fig. 4. It will be noted that the whole tool-holder has been removed from the slide rest, and the head shown substituted for it. By adjusting the slide rest at the proper angle for the teeth of the worm, the teeth are cut by the fly cutter, while the work is indexed by using the index pin in connection with the lathe head. This work is being done by the Victor Talking Machine Co. for the motor mechanism of its talking machines.

A Wide-Range Miller

The small miller shown in Figs. 6 and 7, combines lightness and rigidity to a greater degree than we usually expect to find in so small a tool. The two illustrations show the variety of work which is regularly handled on this machine, Fig. 6 showing a 4-in. milling cutter being used to finish the fork held in the vise as shown.

The other illustration shows the same machine equipped with a dividing head having a draw-in chuck. It also has a very small milling cutter, or saw, of rather unusual dimensions. These saws are used regularly on certain classes of slitting work, the saw shown being 1½ in. in diameter, and having 150 teeth. Its thickness is only 0.003 in., which makes a very delicate milling cutter, and one which can be successfully used only in a rigid machine. This cutter is run at about 150 revolutions per minute, hand feed being used as in the other case.

The machines shown are built by the Rivett Lathe Manufacturing Co., Brighton, Mass.

Special Tools for a 20-inch Shaper

Editorial Correspondence

The more important jigs and fixtures used in building 20-inch Milwaukee shapers.

A milling attachment for the bearing surface on the front of the base, and a pulling device for the rams, when they are being scraped in, are also shown.

The Lutter & Gies Co., of Milwaukee, Wis., has recently added a 20-inch size to its line of "Milwaukee" shapers. Special tools, jigs and fixtures have been made for the various parts of this machine, many of which are shown in the halftones. They show the care that is being taken by this firm to produce duplicating parts.

The drilling and boring jig for the shaper columns are shown in Figs. 1 and 2. In Fig. 1 the jig is practically assembled, and in Fig. 2 it is completely assembled and in place on a column casting. It consists of two side pieces, carrying bushings and having a number of locating surfaces for bushing plates. Some of these plates are transferred from one side to the other.

A ribbed plate connects the two side plates at the top, and this has a number of bushings, as shown in Fig. 1 for the tapped holes for the ram gib adjusting screws. Two straps connect the side plates across the front, and two other straps across the back. Thus when completely assembled the jig is in the form of a frame that fits entirely around the column casting which is to be drilled and bored.

The jig so assembled and in place on a column casting is shown in Fig. 2. It will be seen that the straps across the front are not pulled tightly down into position. The reason for this lies in the fact that the column casting upon which the jig was fitted for the purpose of illustration had not been scraped. Therefore, these straps could not be pulled down to a bearing between the guiding surfaces on the front of the column.

The manner in which the ribbed plate on top is pulled back to a bearing in the V for the ram is also shown in Fig. 2. The various parts of the jig are held together by capscrews and located by pins to insure the proper alignment. A number of setscrews are provided, threaded through ample bosses to hold the jig in

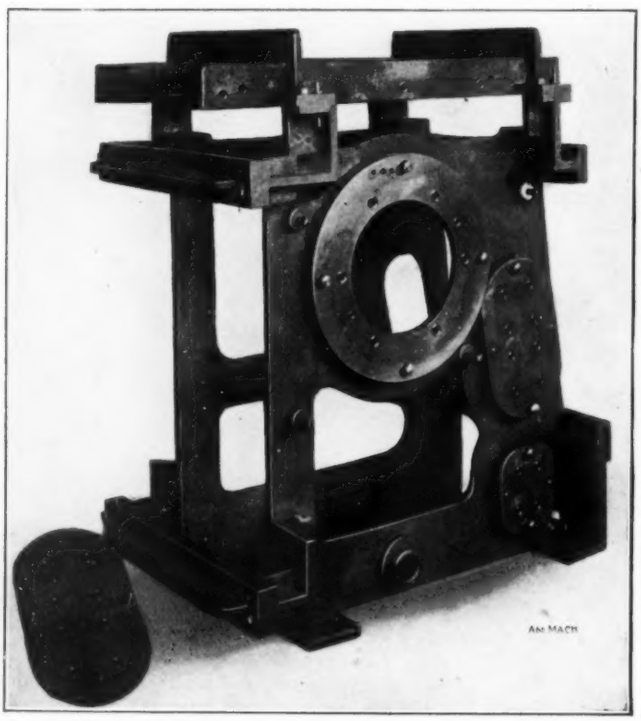


Fig. 1. Drilling and Boring Jig for Shaper Column

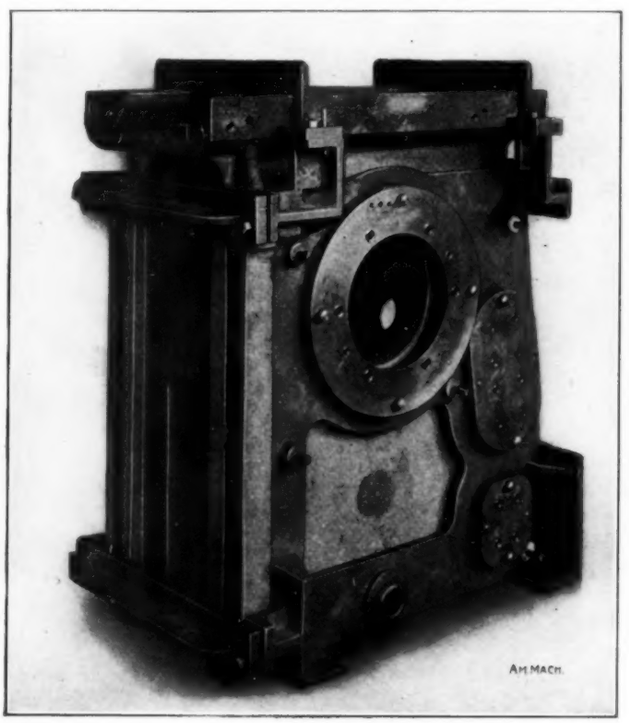


Fig. 2. Jig in Place on the Column

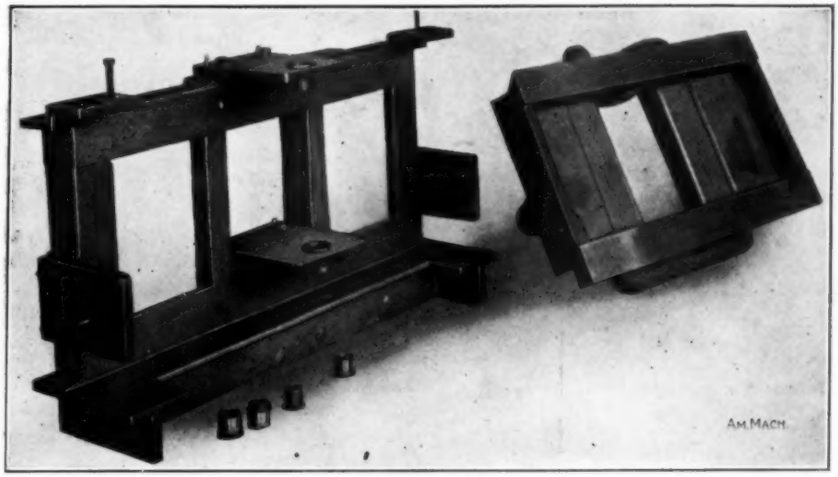


FIG. 3. DRILLING AND BORING JIG FOR SHAPER CROSS-RAIL

the proper position after it has once been set on a column casting.

OTHER DRILLING JIGS

The following illustrations, Figs. 3 to 6 inclusive, show drilling jigs and a few milling fixtures for some of the more important parts of this shaper. The drilling jig and a drilled casting of the cross-rail are shown in Fig. 3. In the position illustrated the face of the jig against which the casting rests is toward the reader. The use of jigs and set bushings and the arrangement of binding screws are so plainly illustrated as to need no detailed description.

In the upper part of Fig. 4 we see the use of a single jig for two separate pieces. The jig there shown drills the barrel, at the right, and also the bonnet cap, at the left. The bull gear is shown at the right lower down, with its drilling jig or template. Unfortunately as arranged, the gear and jig are placed in opposite ways; that is, from the arrangement of the holes it is seen that the gear should have been turned around through an angle of 180 deg., in order to have the holes which have been drilled in it correspond with the bushings in the jig.

In the lower left-hand corner of Fig. 4 is shown a drilled bonnet casting, and in front of it a small plate jig that drills the holes in the finished surface on the side. Here the use of a jig for more than one part is illustrated, from the fact that the holes in the flange of this casting are drilled from the large ring of the column jig, shown in Figs. 1 and 2. This ring is located on the side plate of the column jig by dowel pins and screws and can be removed and used for drilling the mating holes in the bonnets.

The jigs for the parts of the tool slide and clapper box are shown in Fig. 5. The upper parts of the illustration from left to right are the base of the tool slide and its jig, a bearing bonnet and its drilling jig, and the clapper of the clapper box and its jig. In the lower part of the illustration at the left is the tool slide and its jig, and at the right the clapper head and its jig.

In Fig. 6 at the extreme left are shown the gear bracket for the feed mechanism, the drilling jig for the holes, a shaper fixture to surface the bottom, and at the right a milling fixture for holding the bracket to straddle-mill the ends of the bosses.

MILLING ATTACHMENT FOR FRONT OF BASE

A milling attachment to machine the finished surface on the front of the shaper bases is shown in Fig. 7. This attachment is used for all sizes of machines. It consists of a bracket, bolted at one front corner of the base, a splined shaft carried in a bearing from this bracket and

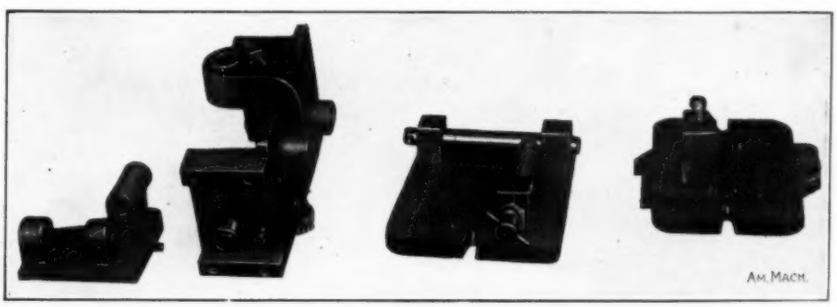


FIG. 6. DRILL JIG, SHAPER FIXTURE AND MILLER FIXTURE FOR GEAR BRACKET FOR FEED

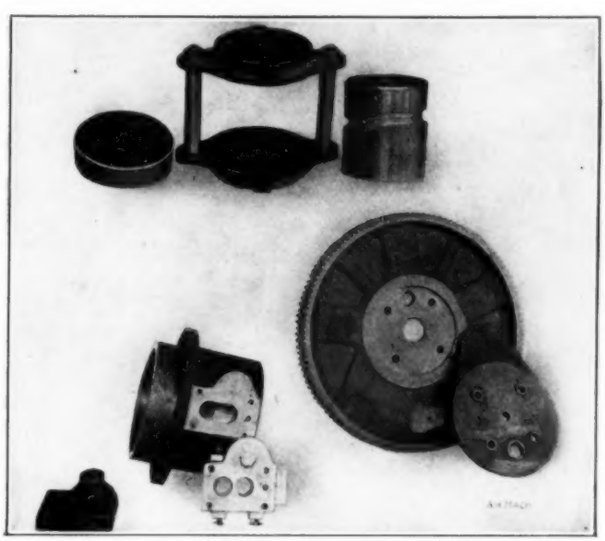


FIG. 4. DRILL JIGS FOR BARREL, BONNET CAP AND BULL GEAR

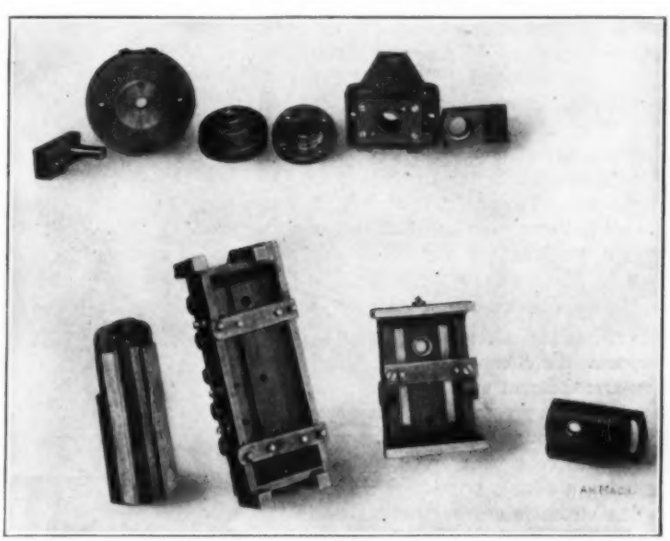


FIG. 5. DRILLING JIG FOR PARTS OF TOOL SLIDE AND CLAPPER BOX

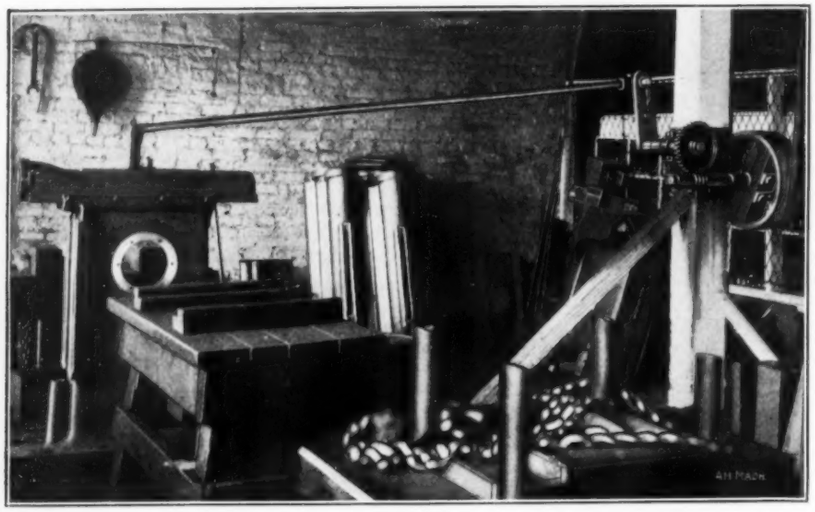


FIG. 8. PULLING MACHINE FOR SHAPER RAMS

running across the front of the shaper and through a driving head for the milling cutter. On this shaft is a worm gear engaging with a wheel upon the cutter spindle. This head is carried in the bored hole in the bottom of the table, which holds the support that extends downward and comes in contact with the machined surface on the front of the base. On one end of this splined shaft and close to the supporting bearing is a driving pulley, which is belted from the small step of the shaper cone. This device when set up is started at one end of the surface to be milled, and is fed across by the regular table feed of the shaper.

The use of pulling machines to help out the scraper hand is not unknown by any means in machine-tool building shops, but such devices are not as commonly seen as one would expect. Various arrangements have been developed, some using hydraulic power, others compressed air and still others some mechanical arrangement.

The rig used in this shop for this purpose is shown in Fig. 8, and consists merely of a slotted bell crank, driven from a pulley through a worm and worm gear in order to reduce the speed, and extending therefrom, a long bar which engages a bracket bolted to the top of the shaper ram. The device is plainly shown. The slotted arm permits of adjustment to shorten or lengthen the stroke as desired.

For heating water for various shop purposes, the cheapest and most satisfactory arrangement consists of a steam jet rather than a steam coil. The objectionable noise caused when steam is turned direct into cold water may be overcome by using a double nozzle, so that the escaping steam is surrounded by a rapidly flowing stream of water. These noiseless water heaters may be home-made or can be purchased in the open market.

Economy in Small Parts

The waste by workmen of small parts, such as nuts, bolts, pins, washers, fittings, etc., is undoubtedly the source of a considerable loss in many shops. For instance, a workman will draw a dozen nuts, and, having used three or four, allow the remainder to lie in the pit or on the floor where they will be lost or will find their way to the scrap bins. The education of individual workmen in habits of economy will, in a shop with a comparatively steady force, accomplish much toward the elimination of such waste. In a shop with a constantly changing force little can be done along this line, and in such cases the minimization of such losses devolves upon the foremen. Requisitions for small parts should not be indiscriminately issued on the request of workmen.

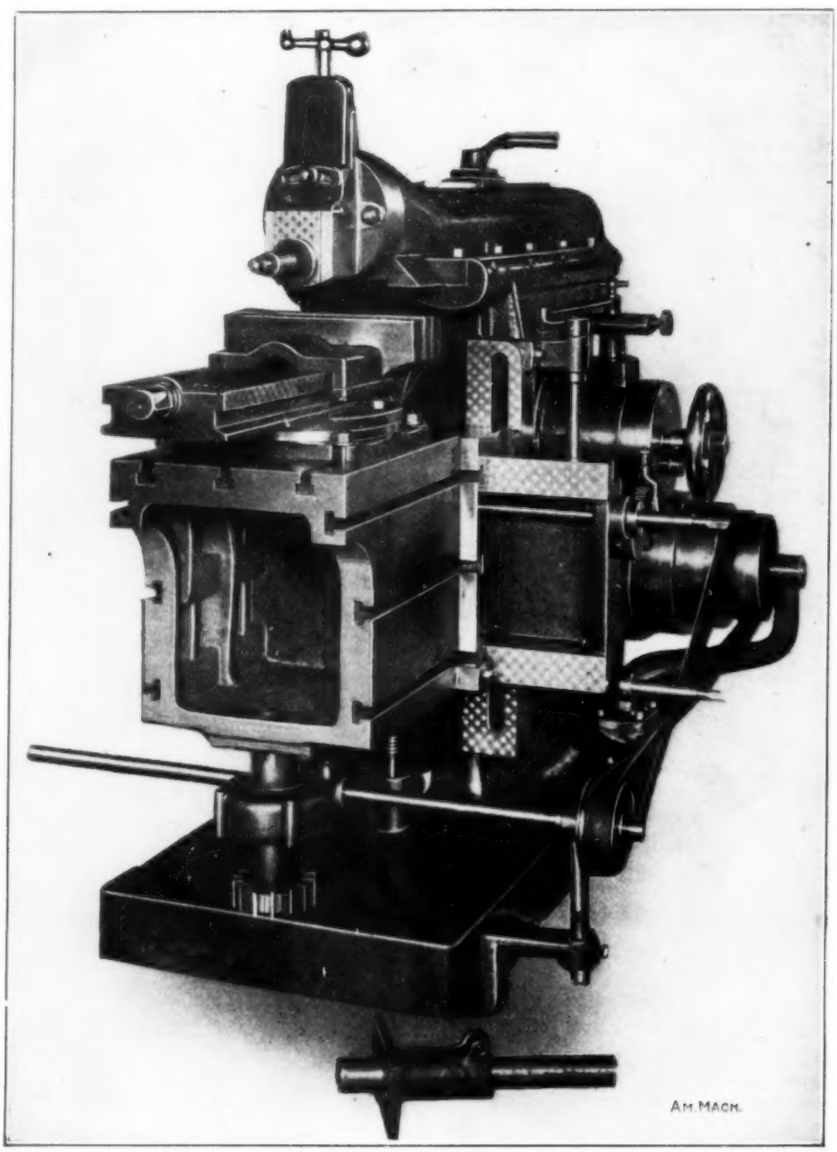


FIG. 7. MILLING ATTACHMENT FOR BEARING SURFACE ON FRONT OF SHAPER BASE

Making Babbitt and Babbitted Bearings

By Jesse L. Jones*

The practice of a large manufacturing concern in standardizing to a large extent the materials and methods used in making babbitt and babbitted bearings.

Two babbitts are principally used which have the properties of fluidity, toughness and softness.

*Metallurgist, Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

The Westinghouse Electric & Manufacturing Co. adopted two principal babbitts, viz.:

A tin-base babbitt that is very easy flowing and suited to pouring extremely thin linings. This babbitt is much tougher and but slightly softer than the original genuine babbitt formula which is often referred to as the "U. S. Government Standard."

The second is a lead-base babbitt that contains considerable tin, flows well and is much tougher and but slightly softer than the usual babbitts of the Magnolia class.

Some use is also made of the lead-antimony, a hard genuine babbitt, and other special formulas that customers may specify.

Making the Babbitt

In order to insure the best results in bearings, only the very best grades of copper, lead, tin and antimony are used in making the babbitt. The use of drossy lead, "off grades" of tin and antimonial lead results in inferior babbitt and unsatisfactory bearings, and is therefore most carefully guarded against.

While the amount of copper in most babbitts is small the use of the electrolytic grades is to be preferred, as some of the "Lake" brands are high in arsenic and this may cause poor adherence of the babbitt lining to bronze shells.

Most of the brands of lead on the market are almost chemically pure but they contain varying amounts of dross and oxide and the only practical way of testing them is to run down 100 lb. or more in a graphite crucible, boil up with green hickory wood, skim off the dross and weigh the clean lead. The same brand of lead may be very clean at one time and drossy at another, and the melting loss in making babbitt from it will vary accordingly, as will also the antifrictional qualities.

There is no real economy in using an "off grade" of tin running from 93 to 98 per cent. of tin, instead of Straits, as it is necessary to pay for the tin content at the market price of tin, and the lead content at the market price of lead, so that all you obtain gratis is a little iron, antimony, dross, etc., that will increase the melting loss and add nothing to the quality of the babbitt.

The grade of antimony to be used in babbitt has been the subject of very extensive practical tests. It has been found that in some cases the better brands, having almost identical chemical analysis, give quite different results in the finished babbitt in regard to hardness. As antimony is used as a hardening agent, and as the total amount used in any babbitt is relatively small, the brand which has given the best practical results, although it is the highest priced antimony on the market, has been adopted.

No really adequate explanation has as yet been found to show why this particular brand gives better results than other brands of practically identical composition, but this fact has been checked so often that it is now accepted without question.

Having secured the best materials obtainable they are melted together in the proper proportions to produce the grade of babbitt desired. It is customary in making a genuine babbitt to combine the copper and antimony, or the copper, antimony and part of the tin to form a preliminary alloy or hardener. This is mixed with the rest of the tin, thus giving a more uniform product.

A temperature of about 900 deg. F. should be used in mixing a babbitt to secure satisfactory alloying, and the surface of the metal should be protected from oxidization by a layer of powdered charcoal. Dross is removed by boiling up

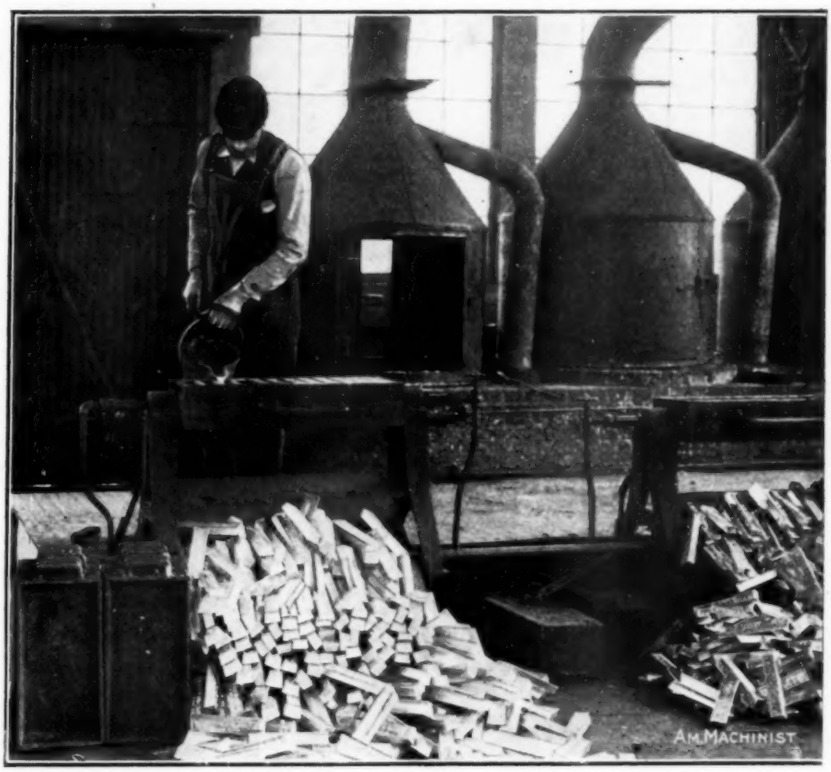


Fig. 1. Pouring the Ingots

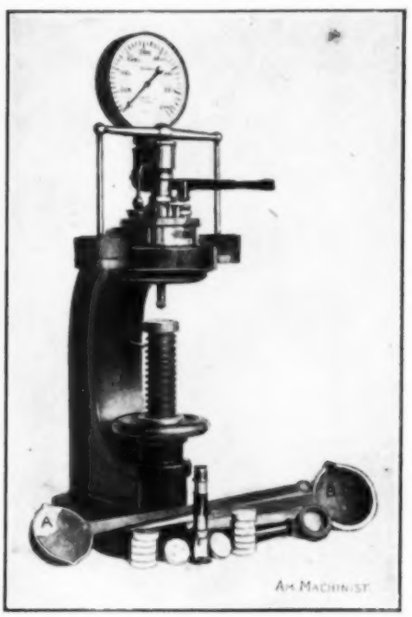


Fig. 2. The Brinell Machine for Testing Hardness

with green hickory wood, and the babbitt may be deoxidized by means of vanadium, manganese, aluminum, magnesium, sodium, etc. When all new metals are used deoxidization is as a rule unnecessary.

Pouring the Ingots

Before pouring into ingots the temperature of the babbitt should be lowered considerably, especially if water-cooled molds are not used, as a finer grain is thus secured.

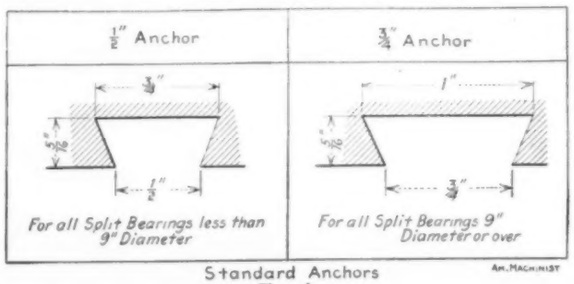
For pouring the ingots a bucket-shaped ladle with a bail and handle and a long, square-nosed pouring spout should be used. It gives a good surface as the babbitting the bearings will take more pains with his work than when rough-looking ingots are given him.

A battery of three 3000-lb. gas-fired babbitt kettles and two 12-gang reversible water-cooled ingot molds is shown in Fig. 1.

The Brinell hardness test has been found satisfactory as a shop test for securing uniformity in the babbitt. Tests are taken from the top, middle, and bottom of each 3000-lb. kettle of the ingot metal and similar control tests are made daily on each of the various babbitt pots throughout the works where the bearings are filled.

Bending, fluidity and peening tests are

Baked Anchor Core
Fig. 3



Standard Anchors
Fig. 4

Anchor Core and Standard Anchors

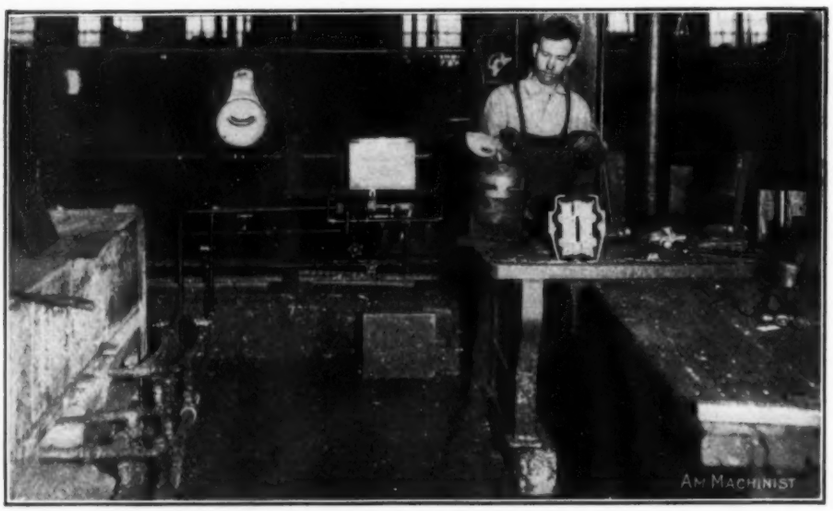


Fig. 5. Pouring a Bearing

metal is less agitated in the pouring than when the ordinary ladle is used. A few ounces of the babbitt should first be poured into the mold, the stream interrupted for a second and then the pouring of the ingot completed. A cushion for the stream is thus formed and the surface is smoother as a result. Small air bubbles are removed by touching with a wooden pick before the metal solidifies.

Taking so much pains to obtain ingots of good appearance may seem unnecessary when the babbitt is for one's own use, but it has been found that the nicer the appearance of the ingots, the better the bearings turned out, as the workman made daily on strips 12x¼x¼ in. Analysis, tensile, compression and specific-gravity tests are also made occasionally, while a babbitt inspector, who is a thoroughly practical man, has general supervision of all babbitt pots and the pouring of all bearings.

The Brinell hardness testing machine, the mold for hardness tests, the microscope for reading the hardness tests, the pouring ladles, etc., are shown in Fig. 2. The ladle *B* in this figure has proved very satisfactory in preventing waste of babbitt by splashing. It has an iron rim, oxyacetylene welded, that prevents splashing in a great measure. A patent has been applied for on this device.

Bearing Shells and Their Preparation

Bearing shells for stationary apparatus are usually made from cast iron, because of its rigidity and cheapness. Where mechanical strength, a certain amount of toughness and cheapness are desired, malleable iron is used.

Shells of cast steel are made for some customers but they are not recommended, as the steel is too springy. It is not uncommon for a steel shell to be machined, ready for babbitting and then remain in the shop for a few weeks. When examined it may be found to be badly warped due to the casting strains being relieved. Warping is very likely to occur also on rebabbitting.

For street cars, etc., standard phosphor-bronze shells are used, because with such a bearing the return of a car to the barn is assured even if the babbitt melts and runs from the bearing. A novel bearing used by one street-car company is a solid shell of Al babbitt weighing 23 lb.

To prevent the babbitt lining from flowing, due to the revolution of the axle, all iron bearings are provided with cast anchor holes or "buttons." These are made by adding to the green-sand core of the casting, baked anchor cores, secured with brads as shown in Fig. 3.

There are two sizes of anchors used, ½ and ¼ in. as shown in Fig. 4. Where bearings are bored before babbitting the cores are made of such length that the holes will be standard after boring. To help the molder in setting the cores, the pattern maker "spots" the pattern so that it will leave small center marks on the green-sand core. Along the straight lips of each half bearing, the anchor holes should be very numerous and as close to the edge as is possible in casting.

With bronze shells, undercut grooves or anchor holes, drilled in diagonally, may be added to prevent the lining loosening in case the bearing has been poorly tinned, but if properly tinned and babbitted, these are unnecessary. The greater the amount of babbitt in the anchor holes of a bronze bearing the greater will be the shrinkage and the more likely the lining will be to be loose and spongy.

A bearing with large anchor holes seldom gives a clear, bell-like sound when struck with a hammer. But if the anchor holes are few and small, the bearing properly tinned and poured with a thin lining, the babbitt becomes an integral part of the bearing, can only be stripped off with great difficulty and leaves a "white frost" on the bronze.

Iron bearings are cleaned in the tumbling barrel, or by the sand blast at the foundry. It is usually necessary to clean out the anchor holes by hand before babbitting, or even to pickle in hydrofluoric acid (especially on bearings provided

with oil-ring lubrication), because any adherent sand will be loosened by the hammering necessary in adjusting the mandrel, and this sand mingling with the babbitt when poured will ruin the bearing.

A bearing that was refilled three times and ran hot each time was finally examined with a microscope and black grains of sand were found embedded in the babbitt. After cleaning the shell with hydrofluoric acid and babbitting a fourth time no further trouble was had.

Rough boring all bearings before babbitting is desirable, as it gives a lining of the babbitt of uniform thickness, a uniform grain and hence a uniform rate of wear.

All iron shells are heated before babbitting to a temperature that will just admit handling them, say 350 deg. F. This heating is done preferably in an oven, but it may be done over a coke or gas fire. In the latter case, especially with bronze bearings, the inner surface that is to be babbitted must be turned upward, otherwise a greasy deposit will form on the bearing that will prevent a good job of tinning, and hence the proper adherence of the babbitt.

The tinning of bronze shells is best done by immersing them in a pot of molten solder of "half and half" composition, using a saturated solution of zinc chloride as a flux, applied with a mop of clean woolen waste. Immediately after tinning, the bearing is placed on the mandrel and babbitted. Unless there is a clean film of molten solder over the entire surface to be babbitted there will not be a perfect adherence of the layer of babbitt.

This will also be true if babbitt has been used for the tinning, as the babbitt has a much higher melting point than the solder, and maintaining a clear molten film with it is difficult. The presence of arsenic in the babbitt, due to the use of cheap antimony, or antimonial lead, will result in loose linings also.

In order to avoid blow-holes and imperfections in the babbitt lining, it is very necessary to coat all mandrels with a very thin coating of clay wash. Put a pound or two of Jersey red clay in a pail of water and stir until suspended, then plunge the heated mandrel into it. The mandrel will soon dry and the molten babbitt will "lie" on it, giving a smooth surface, free from bubbles.

This makes it possible to line a bearing with as little as $\frac{1}{16}$ in. of babbitt and the surface will be so smooth that only 0.008 to 0.010 in. need be machined out for the finish. Brass shells from 1½ to 4¾ in. in diameter are usually lined with $\frac{3}{32}$ in. of babbitt and 0.014 to 0.016 in. machined out. Iron shells are lined with ¼ in. of babbitt and $\frac{1}{16}$ in. machined out.

The use of the clay is especially necessary where oil gets on the mandrels. The oil causes the babbitt to blister. Half an hour's babbitting will not suffice to burn off the oil, but if the clay wash is

BORE FINISHES FOR BEARINGS

The Allowance given on this Sheet must exist after the Bearing is in Place. Normal Bearing Diameter to be Specified on Drawings

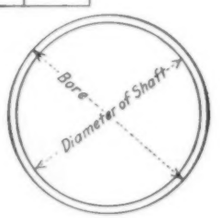
Waste or Grease Lubrication — Oil Ring Lubrication

Shaft Diameter	Allowance Maximum	Allowance Minimum
Up to, not including 3½"	0.008	0.006
From 3½" up to, not including 4"	0.012	0.008
From 4" up to 7" inclusive	0.016	0.012

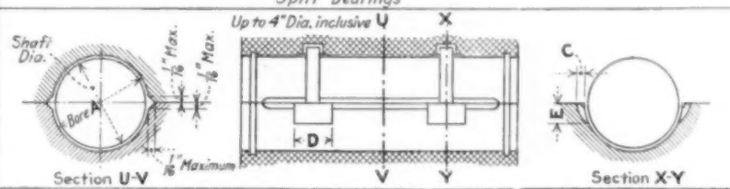
Solid Bearings

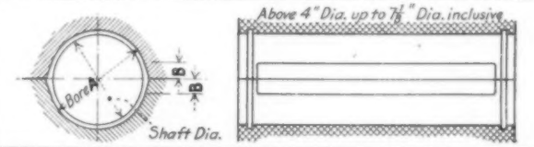
The Workman will in all Cases work to the Minimum Bore Limit

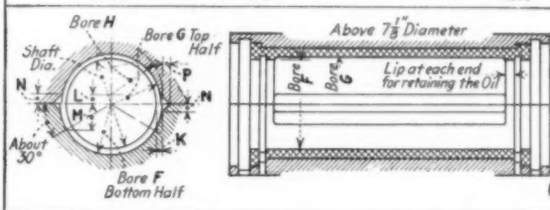
The Maximum Bore Limit is for the Use of the Inspector to determine whether to pass or reject the Bearing



Split Bearings







The Boring Operations

1st Allowance Bore F of complete Bearing

2nd Eccentric side Bore H obtained from Center at Distance L above Center of Bearing, bringing tool out until it touches Bore F at Distance M below Center Line

3rd Clearance Bore G of top Half of Bearing

(X) These Dimensions are for Reference in Drafting Room Only

Nominal Shaft Diameter	Horizontal Bore Limits +on Bore Max.	Horizontal Difference in Size of Shaft & Bore Min.	Horizontal Difference in Size of Shaft & Bore Max.	Vertical Bore Limits +on Bore Max.	Vertical Difference in Size of Shaft & Bore Min.	Vertical Difference in Size of Shaft & Bore Max.	Nominal Shaft Diameter From	Nominal Shaft Diameter Not Inc.	Bore A Allowance	B	C	D	E	Nominal Shaft Diameter From	Nominal Shaft Diameter Not Inc.	Lip	Allowance Bore F	Allowance Bore G	Allowance Bore H (X)	K (X)	L	M	N	P
Up to ⅝ inclusive	0.0015	0.001	0.002	0.002	0.001	0.0015	1½	1 3/16	+ 0.002		5/32	1/2	1/2	Not Inc. 7⅛	8	¼	+ 0.004	+ 0.007	+ 0.068	0.032	1/16	2	3/4	1/16
Above ⅝ up to 1 inclusive	0.003	0.002	0.004	0.003	0.0015	0.002	1 3/16	2	"		"	"	"	8	9	"	"	+ 0.008	"	"	"	"	"	"
" 1 " " 1½ "	0.004	0.003	0.006	0.005	0.002	0.003	2	2 1/4	"		"	"	"	9	10	"	+ 0.005	+ 0.009	"	"	"	2 1/4	"	"
" 1½ " " 2½ "	0.006	0.004	0.008	0.006	"	0.004	2 1/4	2 1/2	"		1/8	3/16	3/16	10	11	"	"	+ 0.010	+ 0.100	0.047	3/32	2 1/2	7/8	3/32
" 2½ " " 4 "	0.008	0.005	0.011	0.008	0.003	0.005	2 1/2	2 3/4	"		"	"	"	11	1'-0"	"	+ 0.006	+ 0.011	"	"	"	2 3/4	"	"
" 4 " " 4½ "	0.009	0.006	0.012	0.009	0.004	0.006	2 3/4	3	"		"	"	"	1'-0"	1'-1"	"	"	+ 0.012	"	"	"	3	"	"
" 4½ " " 5 "	0.010	0.007	0.013	"	"	"	3	3 1/2	+ 0.003		"	"	"	1'-1"	1'-2"	"	"	+ 0.013	"	"	"	3 1/4	"	"
" 5 " " 5½ "	0.011	0.008	0.014	"	0.005	"	3 1/2	4	"		"	"	"	1'-2"	1'-3"	"	+ 0.007	+ 0.014	+ 0.102	"	"	3 1/2	"	"
" 5½ " " 6 "	0.012	0.009	0.015	"	"	"	4	4 1/2	+ 0.004		"	"	"	1'-3"	1'-4"	"	"	+ 0.015	"	"	"	3 3/4	"	"
" 6 " " 7 "	0.014	0.011	0.017	"	"	"	4 1/2	5	"	7/8				1'-4"	1'-6"	"	+ 0.008	+ 0.016	"	"	"	4	"	"
" 7 " " 8 "	0.015	0.012	0.018	"	"	"	5	5 1/2	+ 0.005	"				1'-6"	1'-8"	3/16	+ 0.009	+ 0.018	+ 0.136	0.064	1/8	4 1/2	1	1/8
" 8 " " 9 "	0.016	0.013	0.019	"	"	"	5 1/2	6	"	1				1'-8"	1'-10"	"	+ 0.010	+ 0.020	"	"	"	5	"	"
" 9 " " 10 "	0.017	0.014	0.020	0.013	0.008	0.010	6	6 1/2	+ 0.006	1 1/8				1'-10"	2'-0"									
" 10 " " 1'-3" "	0.018	0.015	0.021	0.015	0.010	0.012	6 1/2	7 1/2	"	"				2'-0"										
							7 7/8		+ 0.007	1 1/8														

AM. MACHINIST

FIG. 6. BORE FINISHES FOR BEARINGS

used the oil is covered up and smooth bearings result.

Cast-iron shells are rarely if ever tinned, as such tinning cannot be depended upon to hold the lining in place. If the shells are made hot enough for the solder to alloy with the iron, the solder will oxidize and will not adhere. If kept cool enough not to burn the solder, the solder will fail to alloy with the iron, and hence will peel off when cool.

After once thoroughly alloyed in this manner, there is comparatively little tendency for the tin to liquate, so long as the temperatures given as satisfactory pouring temperatures are maintained, although stirring of the babbitt during the pouring process is desirable.

The importance of the pouring operation may seem to be exaggerated in this statement, but if it leads the manufacturer to employ a skilled workman for pouring bearings, instead of a laborer, the slight exaggeration will be justified, for the skilled workman will not only pour the bearing properly, but he will also see to it that the quality of the babbitt, its temperature and the tinning are what they should be.

The temperature at which the babbitt is poured is important. If much above 900 deg. F. the shrinkage is very pronounced, and porous areas result, while the babbitt will be dirty and oxidized and its antifrictional qualities injured. Uniformity of temperature is desirable, and this is maintained by the use of a delicate thermostat. The thermostat is set for 860 deg. F. and the gas is shut off when 880 deg. F. is reached, or if the temperature falls below 840 deg. F. more gas is turned on. Fig. 5 shows this apparatus and a general view of the operation of pouring a bearing.

The shape of the lips of the ladle used for pouring bearings is very important. The lips should not be sharp but rounded, so that the stream will not strike either mandrel or shell, otherwise a "burnt" streak will result. A broad stream or an intermittent stream will produce porous areas or masses of blow-holes. A good pourer will keep both elbows close to his body, use a hand leather, so that he can grasp the handle of the ladle near the bowl, and hold his body almost rigid while pouring, thus avoiding any surging of the metal in the ladle, or splashing.

If the pourer is not very skillful, a sheet-iron bridge, *A*, Fig. 2, may be riveted to the lip of the ladle so that it will

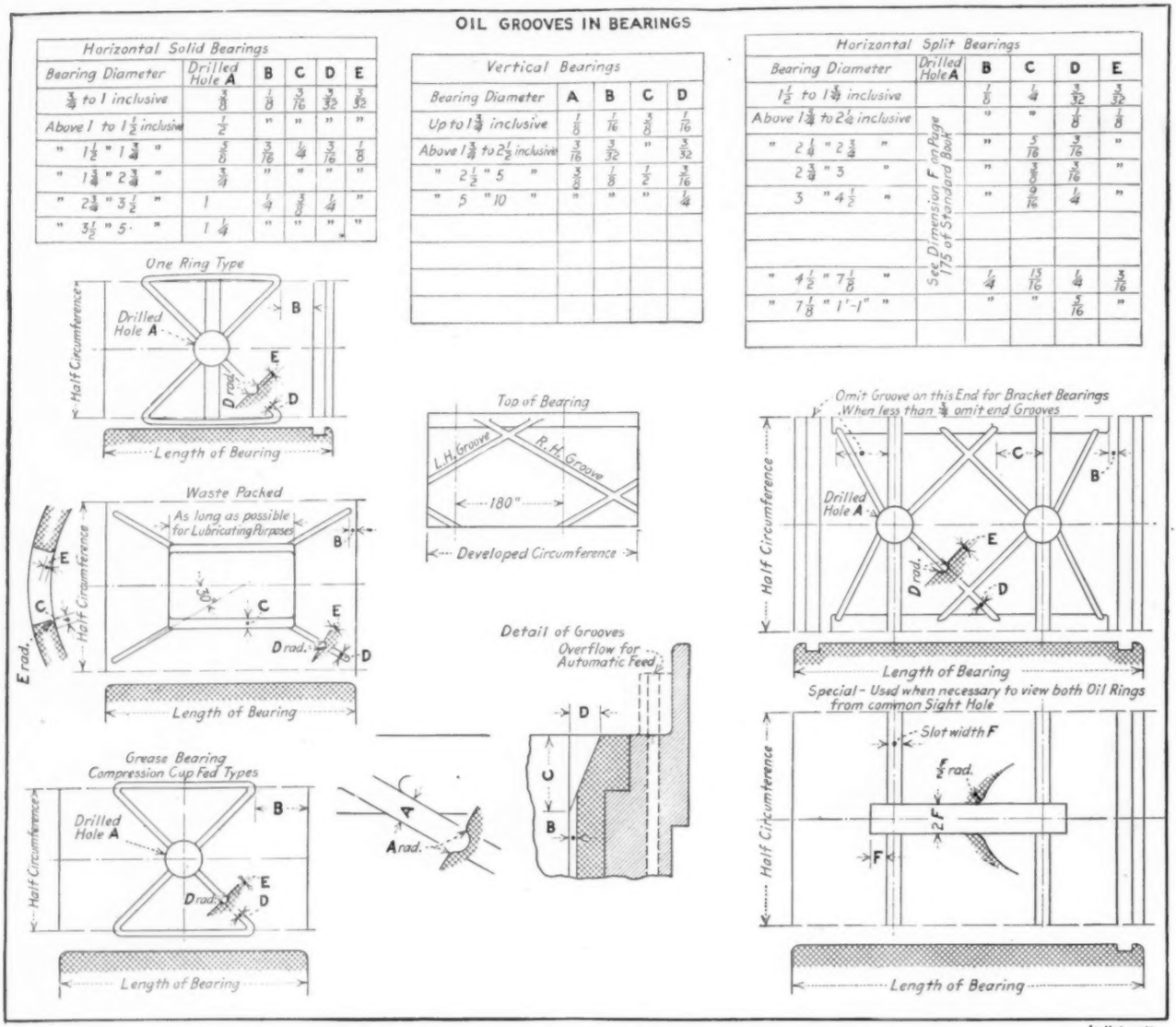

OIL GROOVES IN BEARINGS
Horizontal Solid Bearings
Vertical Bearings
Horizontal Split Bearings
See Dimension F on Page 175 of Standard Book
One Ring Type
Drilled Hole A
Half Circumference
Length of Bearing
Top of Bearing
L.H. Groove
R.H. Groove
180°
Developed Circumference
Omit Groove on this End for Bracket Bearings When less than ¾ omit end Grooves
Waste Packed
As long as possible for Lubricating Purposes
Detail of Grooves
Overflow for Automatic Feed
Special - Used when necessary to view both Oil Rings from common Sight Hole
Slot width F
Grease Bearing
Compression Cup Fed Types
AM. MACHINIST

FIG. 7. WESTINGHOUSE PRACTICE FOR OIL GROOVES IN BEARINGS

POURING OF THE BEARINGS

The babbitt is melted in cast-iron kettles holding about 500 lb., and fired by gas. On first melting the new ingots, or in remelting the babbitt which has solidified after standing in the kettle, it will be found that the tin in the babbitt will commence to liquate at about 450 deg. F.; hence it is necessary for satisfactory work to heat the babbitt to about 850 deg. F. on starting up, and stir very thoroughly before pouring into the bearings, as otherwise the babbitt will not be of uniform composition.

extend some distance below the surface of the metal. It can be adjusted so that it will give a stream of the diameter found best for the bearing being poured. This will not only regulate the stream, but keep the dross out of the bearing, and thus prevent hard spots which cause the bearing to heat up when put in service. A pourer of long experience may not need such a device but it is a good thing for an inexperienced man, as it prevents him from pouring too heavy a stream.

Bearings are preferably poured in a vertical position as this method gives the best results. Some half bearings are poured with the convex side upward, through holes cast in the shell for the purpose, the mandrel resting on a faceplate. Very large bearings are usually poured with the concave side upward. The ladle may be moved along the margin of the bearing when a large surface is to be poured and the lining is not very thick.

Jersey red clay and friction tape are useful in making tight joints at the bottom of the shell and mandrel, or for building up a dam at the top of the bearing, in case extra babbitt is needed to take care of the shrinkage.

Finishing

For cleaning the fins and surplus babbitt from a babbitted bearing, an ordinary "draw knife" such as is used by coopers will be found handy.

It is important, especially where a lead babbitt is used, not to handle the bearings roughly immediately after pouring. The babbitt is weak while hot and if the bearings are thrown upon the floor or given rough treatment, many of the anchors will be broken off and the lining loosened. The increased shrinkage due to pouring at too high a temperature will also cause the breaking off of the anchors.

All solid bearings are broached on a broaching machine, which is also used for pushing out the mandrel. The broching operation makes the babbitt denser and harder and expands it into the anchor holes more tightly. This operation heats up the bearing, and the shell of a bearing of average size expands, so that it is necessary to allow it to reach the room temperature before making the finishing cut.

Where old bearings are rebabbitted, pressing them from the housing may make them under size, hence about $\frac{1}{32}$ in. extra of babbitt is put in them and wher broached the shell is expanded, a cut is taken from the outside and it again fits the housing accurately.

The necessary allowances for the bore finishes of bearings is shown in Fig. 6. These allowances are the result of many years of experience.

Oil grooves are cut in the finished bearings by hand, because as a rule the babbitt lining is too thin to permit their being cast. The grooves are cast in the lining when it is feasible to do so. This can be done satisfactorily, even with a very thin lining, by placing the bearing in a die-caster and babbitting it under pressure, but rough turning the bearing on the outside to a definite diameter is necessary for the die-casting operation.

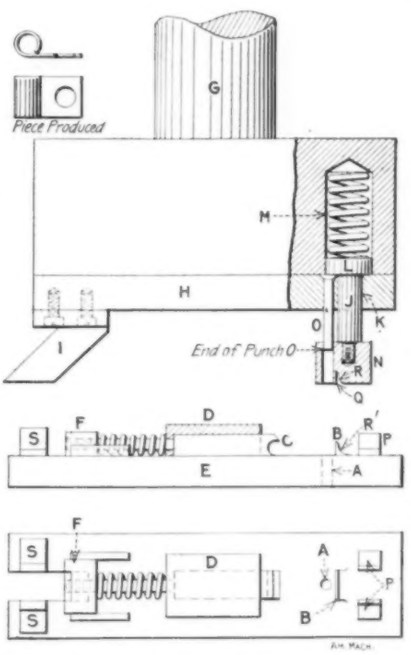
Standard forms of grooving are shown in Fig. 7.

The most important element in the production of a satisfactory bearing is the pouring. The quality of the babbitt is important, the use of a thermostat is important, the tinning is important, but more depends on the actual pouring of the lining than on any other one element.

A Combination Cutting, Piercing and Curling Die

By Peter Steiner

The diagram shows a combination cutting, piercing and curling die used for producing the piece shown in large quantities. This piece was used to support a crystal on one end in a small electric meter. The crystal rested on the curved or curled surface of the piece, which afforded some resiliency in case the meter was jarred, while the hole in the piece afforded means for fastening it to the case of the meter.



A Comb Cutting, Piercing and Curling Die

At *A* is shown the die for piercing the hole, at *B* the cutting die and at *C* the curling die. *C* is a sliding fit in the part *D* which is fastened with screws on the main, or body, part of the die *E*. One end of *C* is turned smaller than the body and the end threaded, onto which is secured the nut *F*. The shank *G* fits into the ram of the press, the plate *H* is secured to the body of the shank with screws. Part *I* is secured with screws onto the plate *H*. *J* is a plunger which is a very close sliding fit in the plate *H* at *K*, while the head *L* of the plunger fits with some clearance in the hole *M* in *G*.

The end of the plunger is threaded, into which the part *N* is screwed very tight. The part *O* is a tight fit in the plate *H*, the back end of *O* being slightly upset while the projecting end is an easy sliding fit in the part *N*.

The material is cut in a shear to proper width before it is placed in the die. The material thus cut is inserted between the gages *P* and then pushed against the curling die *C*. The material, of course, also lies on top of the cutting die *B*. As the punch descends, the part *N* cuts the piece to proper length by the shearing edges *B* and *Q*.

The cutting edge has clearance or shear in back and in front of the cutting edge and in the width of the shear, this amount being equal to a little more than the thickness of the material. As the punch descends further the piece receives a preliminary curling or breaking down between the edges *R R*^{1}. It must be noted that the spring-back of the plunger is of sufficient tension to overcome the resistance of the cutting and breaking-down operations. The part *N* being impeded, the spring is compressed. But the punch *O*^{1} still descends and the part *I* comes in contact with the nut *F*, forcing it and the curling die to the right, the material meanwhile being held tight under *N* and against *E*. The end, having been slightly curled, as already explained, will follow the curved surface nicely as the part *C* advances onto it, thus completing the curl.

Just as the curl is being completed the hole is pierced by the punch *O* which is in a relative position with part *I*. As the punch recedes the blank is stripped off the punch *O* by *N*, which is forced down by the compressed spring on top of the plunger *J*. The curling die also recedes. The spring pushing the nut back accomplishes this movement. The operation can now be repeated after the blank is removed with a pair of tweezers.

This die is easily set up by lowering the punch until the parts *N* and *I* enter the gages *R* and *S* and then pushing the die endways so that the cutting edges meet, then the bolster can be fastened down. It is very important that the plunger is a neat fit, otherwise the cutting edges will spread and not cut the material, which in this instance was very light.

The United States buys about $370,000 worth and exports about $80,000 worth of matches each year, but manufactures for home consumption $6,000,000 worth.

Subpress Tools for Watch Rollers

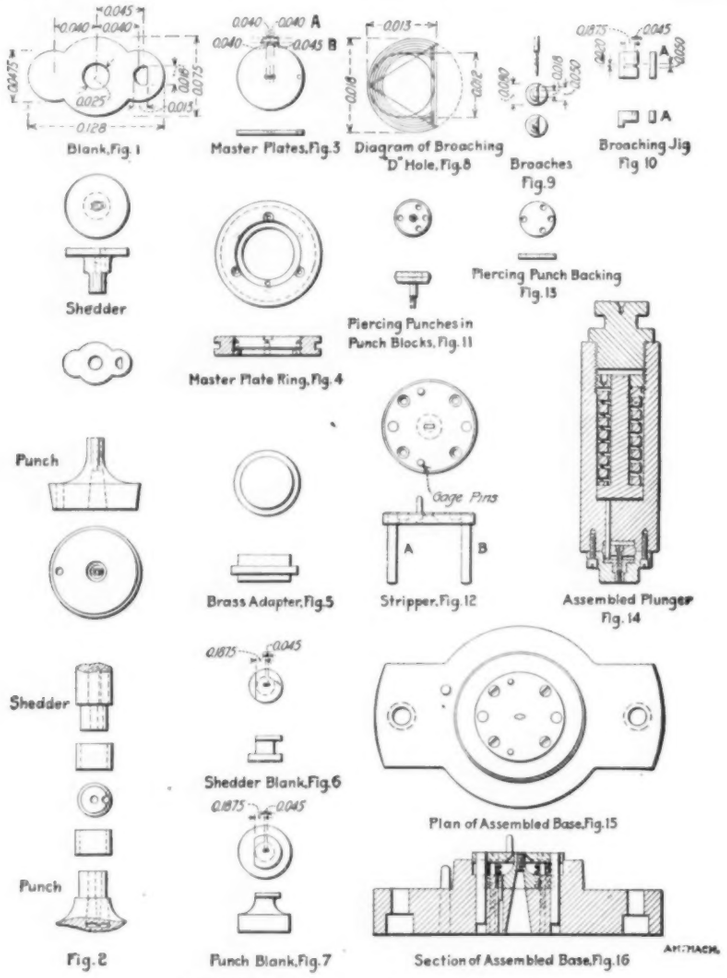
By A. M. Cahill

Details of the making of a precision die for watch work, showing each step in the process.

A series of interesting broaching operations.

The accompanying cuts show a compound subpress die for making a very minute part, to be used as the roller on the balance staff in the escapement of a watch.

The blank, shown in Fig. 1, is of tool steel, 0.015 in. thick. The center hole is about 0.0005 in. smaller than the balance staff, at the position where it is forced in place. The D-shaped hole is to receive the roller jewel, which engages the fork of the pallet, transmitting an oscillating motion to the balance wheel.



SUBPRESS TOOLS FOR WATCH ROLLER

Owing to the fact that this is one of the vital parts in the construction of a watch, it is very necessary that the positions of both holes be as near to the figures as it is possible to place them.

THE DIE

The ordinary method of making a roller die is very simple in comparison with this. In making the punch and shedder, both holes are just ordinary round ones, as shown in Fig. 2. They are reproduced positions from a master plate. The outside hole is converted into a D-hole, for a distance of about 0.050 in. back from the face of the punch and shedder, by grinding away the outside diameter of both small enough to leave approximately two-thirds of the hole.

Then the D-hole is completed by forcing a solid ring on to replace the stock that is ground away, thus bringing both shedder and punch to their original diameters at this point. However, in this way the hole is not actually D-shaped, as its profile has two radii, one of which is formed by the original hole and the other being the radius of the inner wall of the previously mentioned ring.

In making the die there was no advantage in using the master plate until after the D-hole was finished in both the punch and shedder blanks, notwithstanding the fact that the positions of the two holes were just the same as in the ordinary roller. The reason for this was due to the shape and size of both profiles; there was no possible way to make either in two pieces.

The job was commenced by making the two master plates, shown at *A* and *B*, Fig. 3. The master plate *A* was used for the profile work on the punch and die, shedder and stripper, *B* being used for the positions of both piercings. These master plates were made with dowel holes, to be dogged together in the ring in relative plan to both holes in the profile of the blank.

The master-plate ring, shown in Fig. 4, was counterbored deep enough to hold both master plates at the same time. Fig. 5 shows a brass adapter to be used in the face of the master-plate ring opposite the plates.

PUNCH AND SHEDDER BLANKS

After the work on the master plates, ring and adapter was completed, my attention was turned to both punch and shedder blanks. These were made up in the form shown in Figs. 6 and 7. In the punch blank the relief hole was worked out central with both holes in the face of the punch, so as not to remove any more stock than was necessary, thus allowing the punch as much reinforcement as possible, at this point.

Both holes to receive the piercing punches were then bored in the shedder from the back, leaving a thickness of about 0.125 in. to be made the size of the working end of the piercing punches. This completed, it was decided that the best way to make the D-hole was to drill a hole 0.010 in. in diameter and broach it to the required shape. This was done by first sketching a diagram of the work of a series of broaches best adapted for converting a hole 0.010 in. in diameter into a D-shaped hole, measuring 0.018x0.013 in. from flat adjacent to the opposite side of the circumference.

In making this diagram it was found that the amount of stock removed from a circular hole to make a D-hole of the proportions mentioned was very much one-sided, and that if a series of symmetrical D-shaped broaches was simply made, each in its turn would have a tendency to take its easiest course, and perhaps make a very bad job of the broaching operation. Consequently it was decided to remove most of the stock

that occupied the space between the rough-drilled hole and the points where the 0.018-in. circle came in contact with the flat side of the D-hole. The broach best adapted for this work was of triangular shape. However, in accordance with the sketch, Fig. 8, it was thought necessary to make nine cuts with a series of broaches, there being one short and one long broach to each cut, as shown in Fig. 9.

The first two broaches were of the triangular shape, while the other seven were consecutive D-shaped, each 0.001 in. larger than the preceding one. To make sure that the triangular broaches would remove the stock at only the points previously stated, the apex was not brought up to a sharp edge, but the corner was rounded so that it simply guided the two cutting corners of the broach.

The broaching fixture shown in Fig. 10 was made of tool steel, hardened and ground. Both holes were ground, the distance from right angle to center of holes being regulated by spacing with size blocks against a parallel square upon the faceplate of the lathe. The holes for guiding the broaches were ground away to the same relative dimensions of the flat side of the D-hole in the blank.

After the broaches and fixtures were completed, the work was again started on the punch and shedder; each blank being previously finished to the form shown in Figs. 6 and 7, except that the protruding table was left round. Each blank in its turn was secured with solder to a well made parallel piece of steel, then clamped against the parallel square upon the faceplate and true with the periphery of the flanged face. The center hole was then drilled, bored and reamed to about 0.003 in. under size, and at the same time the diameter of the flange was accurately turned to 0.600 in. It was then moved along on the parallel square, spacing the distance by using a parallel block of the required size to locate the position of the 0.010-in. roughing hole central with the profile of the D-hole.

After drilling the 0.010-in. hole, the blank was removed from the faceplate, the parallel block was placed upon the magnetic chuck of the grinder, on the side parallel with the center lines of both holes and the flat surface on the periphery of the flange was ground until it measured just 0.4875 in. from the opposite side of the circle, this being the exact relation to figures on the broaching jig from the shoulder to the center hole.

The Broaching Operation

After this was done the broaching operation was in order. A pin was fitted to the center hole in the fixture, the other end of which piloted into the center hole in the blank. Then the fixture was pinned in place with right angle faced up against the flattened part of the flanged table and soldered securely on both sides. The small parallel block marked *A*, in Fig. 10, was then clamped in place against the side of the fixture, thus closing the hole to receive the body of the broaches. Next, the first triangular broach was inserted in the fixture and lightly tapped with a hammer to the required depth. This was later extracted and replaced with the long broach that continued the cut into the larger hole.

On examining the work of the first broach, it was observed that the stock was nicely and evenly removed at each required corner. After making the second cut with broach No. 2, the broaching operation was continued by alternately using a short and then a long broach until the last broach finished the hole, leaving a very smooth and perfect inside finish of the exact required measurements. Both punch and shedder were continued through these same proceedings.

Milling Punch and Shedder Profiles

The broaching operations completed, milling the profiles of both punch and shedder was undertaken. This was done from positions on the master plates. Both master plates were pinned together into their seat in the master-plate ring, *A* being on the inside while *B* was exposed. A plug 0.018 in. in diameter by ¼ in. long, flattened about one-half the length to 0.013 in., was fitted to the D-hole, allowing the round part to protrude sufficiently to be used as a contact point for the indicator.

The brass adapter, shown in Fig. 5, was then fitted to the master-plate ring with an easy wringing fit; the center hole in the exposed master plate was slipped over the chuck pin, and clamped securely against the faceplate of the lathe. The punch blank was then soldered to the brass adapter, true with the rough-bored center hole in the face of the blank. Next, the master plate was shifted from the center hole to the position established for the D-hole. The clamping screws which secured the brass adapter were then released sufficiently to allow it to be turned around in the ring until the plug in the D-hole was dead true with the pinned position in the master plate.

After this was done, the master plate *B* was removed without disturbing *A*, and the profile of the punch was worked out to its required radius with a small V-shaped cutter in the milling attachment of the lathe. The shedder was carried through the same proceedings as the punch.

The punch block, shown in Fig. 11, was made from master plate *B*. The holes were so close together that it was decided to have them open into each other, to admit a piercing punch with a body large enough to withstand the resistance while being operated. This necessitated the grinding of a flat surface, on the body of both piercing punches, to the correct thickness required to be pushed into the semicircular openings.

The die and stripper were both made from positions in the master plate *A*. As the holes opened into each other, it was necessary to drive a soft plug into the center hole, so that the two small outside holes would have a complete circumference, thus giving the reamer a chance to follow the hole with an even concentric cut. The stripper shown in Fig. 12 was made in like manner to the die, the holes being made about 0.004 in. larger for clearance around the punch while in the die; there was an allowance of 0.003 in. for grinding.

Miscellaneous Operations

After this all the dowel holes were drilled and reamed, screw holes were drilled and counterbored in the punch die and stripper. Then these three pieces were packed in crucibles of powdered charcoal and allowed to remain in the furnace under slow heat for about two hours, after which they were hardened by plunging into a bath of oil. The die and punch block were drawn to a temper that would melt solder, while the stripper was drawn down to a dark brown.

These three pieces were then ground on both faces on the surface grinder. The stripper was fastened to a solder chuck, true with the opening in the center. This was ground on the periphery to fit the recess in the base with a sliding fit, the upper corner being broken, by grinding at an angle of 45 deg. It was then released from the solder chuck, and both holes to receive the pilot pins *A* and *B*, in Fig. 12, were ground upon the faceplate of the lathe. The die was fastened to a solder chuck, somewhat smaller than the face. The opening in the back was ground to receive the platter of the shedder, and one-half the thickness of the punch block on a 5-deg. taper. The outside was also ground in this setting. It was then released from the solder chuck and fastened to the brass adapter, true with the center hole in the master plate on the chuck pin. The master plate was shifted from the center hole to position for the side-circular wing of the blank. The clamping screws were released and the die on the adapter was turned in the ring until the rough holes were approximately central with their positions in the master plates. The die was then finished by grinding all three circles from their respective positions.

The work on the hardened punch block was started by grinding the locating dowel hole and lapping the three shedder-pin holes. It was then fastened to the brass adapter and carried through the same proceedings as the die, with

the master plate *B*. The opening for the D-punch was first ground; afterward the opening for the center punch and the outside periphery were ground at a double angle of 5 deg.

Further Punch and Shedder Work

After the die, stripper and punch block were completed, attention was again turned to the punch and shedder. Both of these were fitted to the die the entire length of their working part. Both were put through the same process of hardening that the other three pieces were given and afterward drawn to a dark brown. The die was clamped dead true to the faceplate of the lathe. The punch was inserted into the die to the full depth of its working end, and the base was ground on the periphery and face, to fit the seat in the subpress base with a $\frac{1}{32}$-in. drive on a 1-deg. taper. The shedder was also pushed into the die to its full depth and ground on both faces of platter, also on the periphery to a sliding fit in the straight part of the opening in the back of the die.

The die was then removed from the faceplate and the shedder was pushed into its regular position from behind. The die was again clamped to the faceplate with face out. It was made to run dead true, and the center hole in the shedder was ground to figures, after which it was released and the D-hole cleaned by using a little oilstone powder and oil on a piece of wire ground flat to the same proportions as the hole. The openings in the back of the shedder, to receive both piercing-punch bodies, were ground from the chuck pins engaged in the holes in the face of the shedder.

The center hole was first ground, and the other hole was ground from a D-shaped pin engaged in the D-hole. The piercing punches were made up, hardened and drawn to a dark brown on the working part. Both were ground to fit their respective openings in the punch block with a slight drive up to the shoulder, while the part that entered the shedder was lapped to a sliding fit, afterward being ground equally flat, and the working end of the D-punch made to figures.

The blanking punch was lightly driven into a brass chuck, turned to receive the base, and the center hole was ground with a slight back relief. The D-hole was relieved by means of a piece of drill rod 0.020 in. in diameter, filed to a taper of 0.004 to the inch, and ground flat to the same relative proportions of the D-hole. This was used with fine diamond powder and oil, being forced by hand into the hole from behind with a sliding motion.

Final Operations

Arriving at this point, the die was completed, with the exception of some of the regular routine of fitting the punch block, along with the piercing-punch backing, shown in Fig. 13, to the plunger, making screws, dowels and springs, and lining up the lower punch.

The work of lining up the punch was the last and most important part of the work. This was done by making a brass ring that acted as a distance piece between the face of the die and the top surface of the base of the punch, it being just thick enough to allow the punch to enter the die to a depth of about 0.025 in. Then the base of the subpress and stand were put together, placed under the screw press and the punch forced into the seat of the base. The locating dowel hole in the punch was then continued into the cast-iron base, and the pin was driven home. This completed the entire job, as shown in Figs. 14, 15 and 16.

The Dividing Head and a Labor-saving Milling Fixture

By F. P. Terry

The dividing head has become one of the most important fixtures in modern shops. There are now several reliable styles and makes of this head, all of which require very careful handling if they are to fulfill the object of their manufacture. They do not look very well on the table of some of the real old millers still in use, nor is it advisable to trust the care of this fixture to the class of labor accustomed to operating the old machines.

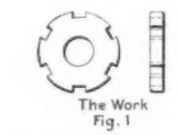
In every shop there is some work which requires some sort of dividing and which hardly calls for the accuracy of the dividing head and the careful workman to take care of it. To meet this class of work, I have designed many jigs and fixtures of as simple a form as possible, and which can safely be left to the indifferent shop hand.

At Fig. 1 on the accompanying cut is shown a mild-steel nut of which we require a large number. These require six flutes as shown. At Fig. 2 is shown one of the arbors, having a hexagon portion in the center which acts as a shoulder to clamp the nuts against, six of which are placed on from each end.

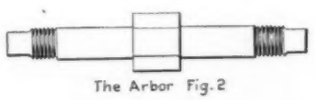
At Fig. 3 is shown the fixture complete, the cast-iron cradle being machined out to receive the two arbors as shown; the center column also having a saw slot from the bottom of the seats to below the stud-bolt which allows this bolt to securely clamp the arbors. The face of this column also looks after the thrust of the cutters. Plate *B* is a setting plate screwed and doweled to the cradle.

After each cut across, the stud-bolt *A* is released and the arbors lifted and turned one position, six cuts across in this case completing 24 nuts. With four arbors, to allow changing the nuts while the machine is operating, a great number of these nuts can be quickly run through. The setting plate *D* and the arbors may be changed to a different diameter or division, one cradle being used for several different jobs.

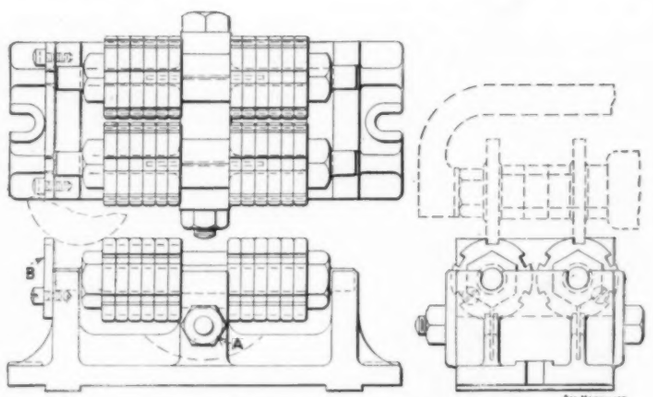
With fixtures of this description a great variety of jobs can be satisfactorily handled and the dividing head spared a good deal of rough usage.



The Work Fig. 1



The Arbor Fig. 2



Fixture Complete Fig. 3

Dividing Head and Labor-saving Milling Fixture

Announcement was recently made to the effect that the Bessemer & Lake Erie R.R. has placed an order for 100 all-steel box cars, these, except some 26 cars built and placed in service by the Union Pacific R.R., constituting the first large order for such equipment to be entered by any road in this country.

Making the Jacobs-Shupert Firebox

By J. F. Whiteford*

The design of the sectional fireboxes necessitates methods of construction very much different from standard practice.

The use of the forms and dies shown here greatly simplifies the manufacture and assembling.

*Bonus supervisor, Atchison, Topeka & Santa Fé Ry., Topeka, Kan.

Owing to the design of the Jacobs-Shupert sectional firebox, principles and methods of construction are encountered very much different from standard practice. In this firebox the crown and side sheets are made up of steel plates bent into U cross-sections. These sections have their bulged portions toward the fire, the flanges extending into the water space.

Stay sheets are interposed between the flanges of adjacent sections when riveted together, giving a tight joint and at the same time making the crown and side sheets take up the longitudinal expansion and contraction due to temperature variations.

The wrapper sheet, or outside casing is made up of a series of sections placed between the outwardly projecting stay sheets. The flanges of these sections project outwardly so that the adjacent ones with interposed stay sheets are riveted together. In this manner the outside seams are caulked and made steam-tight.

The door sheet and the firebox flue sheet are extended outwardly to act as a staying member. The flue sheet extension is between the flange of the throat sheet and front flange of the front outside section. The door sheet is extended outwardly to act as a staying member and is placed between the rear flange of the rear outside section and the outwardly projecting flange of the back head. These flanges are riveted together forming seams similar to those of the stay sheets and outside sections.

Through the use of forms and dies the manufacture is much simplified and the assembling is greatly expedited. At the same time interchangeable parts are insured, an important factor in maintenance cost that is too often overlooked. The sections, stay sheets, door sheets, flue sheet and throat sheet are ordered from the steel mills sheared to shape, eliminating the extra charges for shearing. The strips are heated in a furnace and formed in a specially designed, hydraulic flanging press, Fig. 1, the arched form and U-shape being given to the section at a single operation.

After leaving the flanging press the inside sections are drilled for rivet holes by using a jig in which case-hardened bushings are inserted in order to secure uniformity. When drilled the flanges are laid out and bevel sheared and the bottom of the sections are then reverse lapped for connection to the mud ring. All necessary chipping around the bottom of the sections is done before assembling. The outside sections *E* and *F*, Fig. 2, are formed on the same hydraulic flanging press as the inside sections, by changing the dies. All the rivet holes are put in according to the jig shown in Fig. 3. The bottom of the flanges are cut away for laying up against the mud ring.

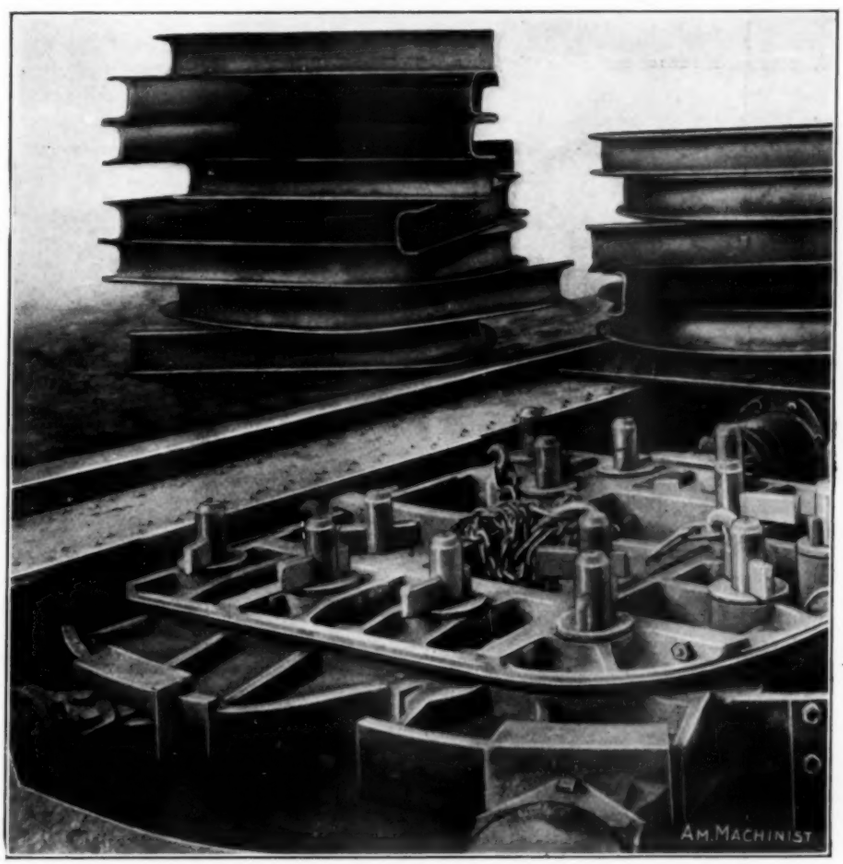


FIG. 1. THE HYDRAULIC FLANGING PRESS

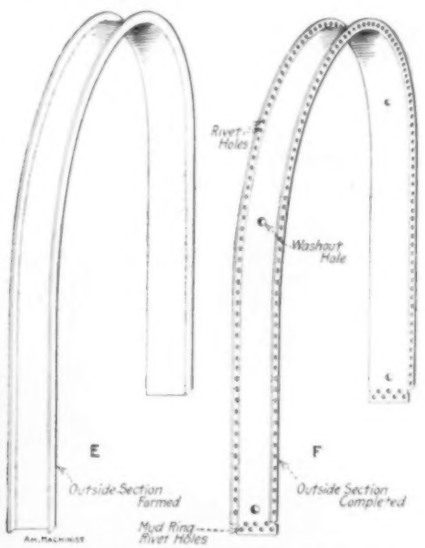


FIG. 2. OUTSIDE SECTIONS FORMED ON HYDRAULIC FLANGING PRESS

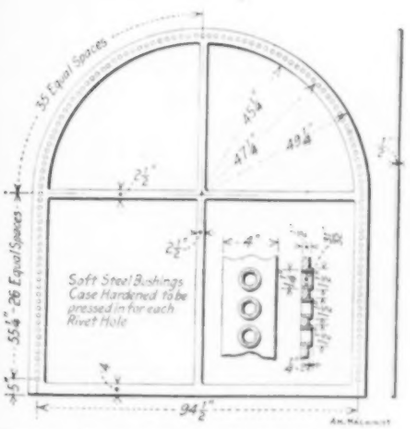

35 Equal Spaces
55¼" 26 Equal Spaces
Soft Steel Bushings Case Hardened to be pressed in for each Rivet Hole
94½"
AM. MACHINIST

FIG. 3. TEMPLATE FOR DRILLING OUTSIDE SHELL SECTION

In Fig. 4 at *A* is shown the shape of the stay sheet as it comes from the mills. At *B* it is shown with all the circulation holes and center cut out.

The stay sheet is completed by drilling all the rivet holes by a jig. The burrs on the edges of the sheets and rivet holes are chipped off and the stay sheets are ready for assembling. The flue sheet is ordered in the same shape as the stay sheet shown in Fig. 4 at *A*. The stay-sheet jig is used for drilling the seam rivet holes.

FIG. 5. THE FINISHED THROAT SHEET

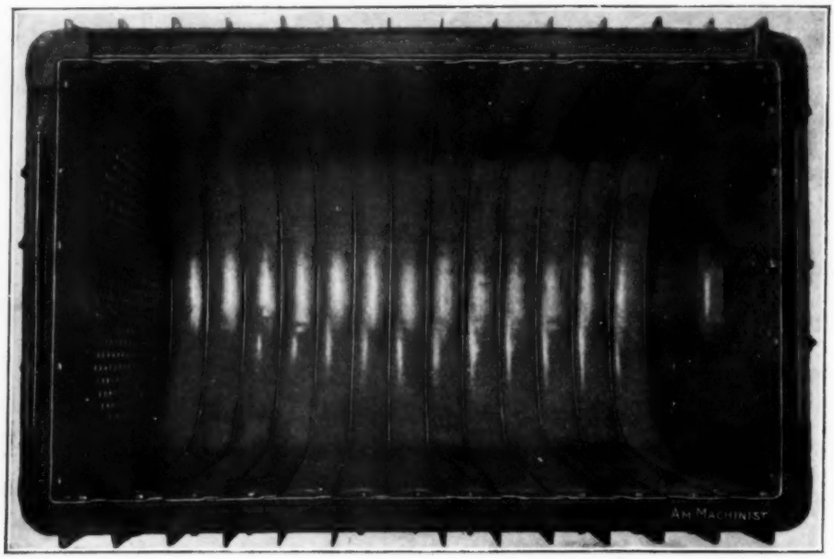


FIG. 8. THE INSIDE OF THE FIREBOX

The door sheet is ordered in the same shape as the flue sheet and the stay sheet, Fig. 4, *A*. The jig used for drilling the seam rivet holes in the flue sheet is used on the door sheet. The back head is ordered in the same shape as the flue sheet, stay sheets and door sheet. It is formed into the finished shape by formers used on a four-column, hydraulic flanging press. The door-hole flange is put in at the same operation as forming the back head. The seam rivet holes are drilled by the jig which is used for the outside sections.

The throat sheet is ordered the same shape as the stay sheets, door sheet, back head and flue sheet. Fig. 5 shows the completed throat sheet. The first of the two operations in forming is done with the back-head dies. In the second or finishing operation a plunger is employed for making the shell fit. Both the back-head and the throat-sheet formers are used on a vertical four-column, hydraulic flanging press.

The finished throat sheet, with jig in position for drilling the connection rivet holes, is shown in Fig. 5. The outside-section rivet holes have been drilled according to the template shown in Fig. 3. The mud-ring rivet holes are drilled with the ring in position for the template. The outside and inside of the mud ring are finished so that the ends of the sections will set up close. All the rivet holes are drilled by jigs so that all the mud rings will be alike. Fig. 6 shows the

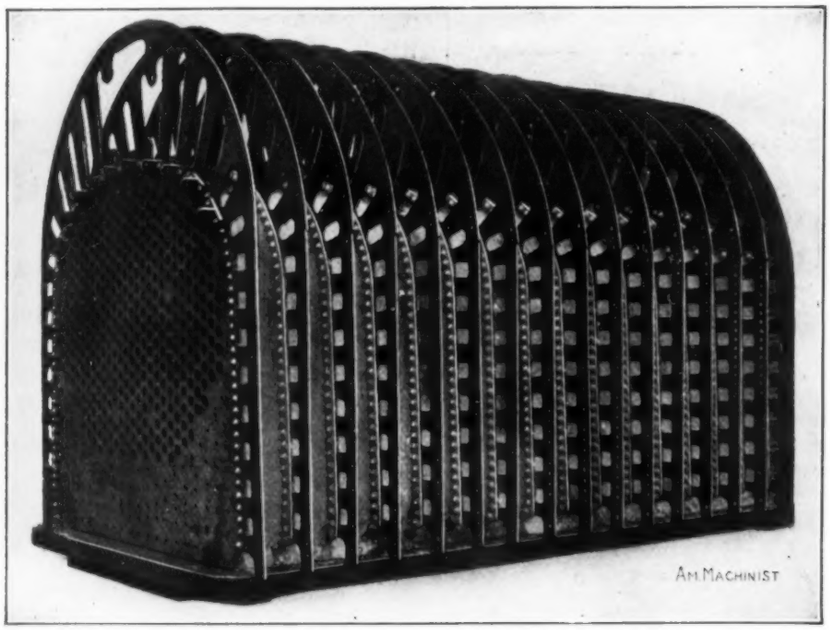


FIG. 6. THE FIREBOX READY FOR APPLYING THE OUTSIDE SECTIONS

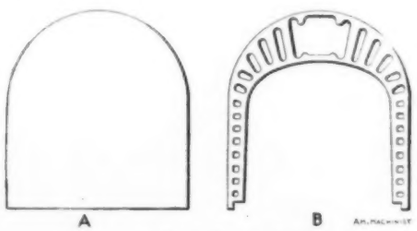


FIG. 4. THE STAY SHEET

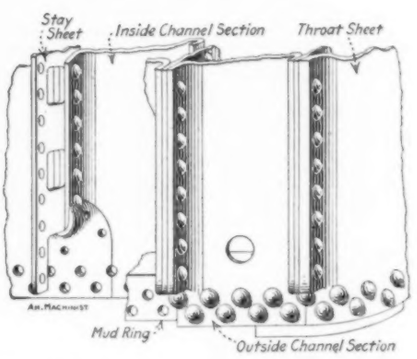


FIG. 7. THE METHOD OF LAYING UP THE CHANNEL SECTION TO THE MUD RING

inside sections with stay sheets, flue sheet and door sheet set up on the mud ring. All the laps are set up and the inside seam rivets driven. All the calking is done and the firebox is ready for applying the outside sections.

How the sections are lapped at the botton is seen in Fig. 7. Threaded plugs are applied in the inside sections and the laps inside the water space are calked. Beneath the stay sheets, outside, the sections are butt-jointed and laid flat up against the mud ring. All the rivet holes in the bottom of both the inner and outer sections are drilled in position, eliminating any liability to error.

Fig. 8 shows the inside of the firebox.

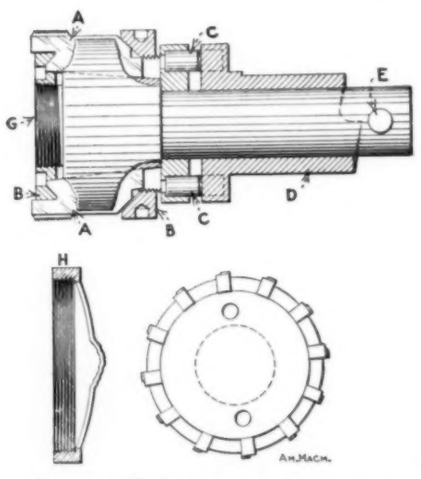
Tap for Tapping to a Shoulder

By A. R. Cooper

The tap here illustrated and described is the result of a series of experiments made to obtain a tap which would bottom and yet not distort the casting. It is practical when applied to brass castings with a small amount of stock as shown in the illustration.

It was found that a tap made with four, six and nine chasers distorted the casting in such a manner that it spoiled the seat *H*. Twelve chasers seemed to meet the requirements. The tap is made with quite a range of adjustment.

The chasers *A* are made with a taper



Tap for Tapping to a Shoulder

of about five or six degrees. They are moved forward or backward by tightening or loosening the adjustment rings *B*. A special spanner wrench is made for this purpose.

The chasers are made of high-speed steel hardened on the cutting edge only. The chaser slots are milled to bring the front edge of the chasers slightly higher than the back edge, giving clearance to the thread and allowing for grinding.

The decrease in diameter caused by grinding is kept to standard size by use of the adjusting rings. Releasing pins *C* are hardened and are fitted to match the pins in the stationary shell *D*. The pins in the releasing shell are made short to allow of quick release in case the operation strikes the bottom of the hole with too much force.

In reversing, the slot or notch milled in the stationary shell engages the hardened reversing pin *E*, which action retards the movement of the chaser core *G* until the tap has backed out of the work.

The chasers *A* are made on a specially made master holder which exactly matches the core *G*. They are held in this holder by a ring which circumscribes the chasers and holds them in position by means of suitably located setscrews. By turning them in this way, the adjusting ring tapers and threads may all be turned at one setting, assuring accuracy and alignment.

The chaser slots in this master core are milled in such a manner as to bring the center of the chaser bands to coincide with a plane passing through the center of the core. The chasers are numbered consecutively to facilitate placing in the tap.

They also carry an individual letter symbol to prevent mixing them with another set. If this tap is made with care, all steel parts properly hardened and chasers correctly inserted, it will last from 12 to 18 months without any maintenance expense whatever. It has also increased output of tapped parts 25 per cent. and secured an absolute gage fit of all tappings.

A Demagnetizer

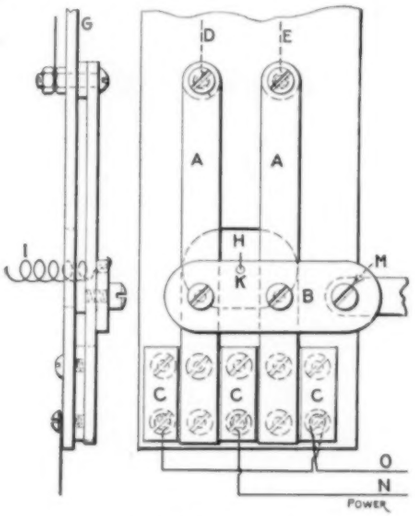
By E. M. Long

We have in use on our surface grinders several magnetic chucks. These chucks have the regular two-throw switch so wired to one circuit that throwing the switch from one contact to the other reverses the current through the chuck for the purpose of removing the work. As the work, when it left the chuck, was magnetized, we rigged up the following way to overcome this trouble.

Instead of wiring up in the regular way, we connected two circuits, one to each pair of contact points, thus making a four-strand cable to the ceiling, where one circuit was connected to the main, while the other was connected to the device illustrated. *AA* are two pieces of soft steel 4x⅜x⅛ in. mounted at *DE* on a piece of ⅛-in. hard fiber as shown at *G*. These are spaced $\frac{7}{16}$ in. apart and tied together by a piece of ⅛ fiber *B*. *CCC* are pieces of steel 1x⅜x⅛ in. mounted on the fiber board, the spaces between them being filled with two pieces of fiber 1x$\frac{7}{16}$x⅛ inch.

A hole *H* is cut through the fiber board for the coil spring *I* to pass through and connect to the fiber link *B* at *K*; this is to hold the piece in contact. At *M* a steel link is attached to the tie *B*, the other end being attached to a crankpin on a small countershaft, this countershaft is belted to the grinder countershaft and should run about 400 r.p.m. The crank should have about $\frac{5}{16}$-in. throw so as to move the bars *AA* from one pair of *EE* to the other. The main is connected at *D* and *E*, while *N* and *O* are the other two wires down to the chuck.

When the grinder is running and the switch is thrown so as to close this cir-



A Demagnetizer

cuit, an alternating current through the chuck is formed, making it very easy to remove the work, which, at the same time is demagnetized. This is much more convenient than placing it on a regular demagnetizer, while the first cost also is much less.

These have been in use a number of years and the only care they required was the renewal of the contact bars, perhaps once in two years; there is but very little sparking. Our current is 110 volts.

A dipping method for blackening small iron parts, in which two baths are used, is as follows, according to *Metalltechnic*: The first bath is made by dissolving 10 weight parts of copperas in twice the weight of water, also 15 parts of chloride of tin likewise, mixing the two, adding 20 weight parts of hydrochloric acid and diluting it all in about 400 parts of water. The articles are immersed in this bath for 10 seconds, rinsed in water and immediately placed for three minutes in the second bath, which is composed of 3¼ lb. of "hypo" (sodium thiosulphate), ¼ lb. of hydrochloric acid and 2½ lb. of water. It is produced by first dissolving the hypo in hot water, and the hydrochloric acid should not be added till the bath is to be used. There is a strong, visible action when it is poured in, and a yellow precipitate is formed which should be removed from the solution by filtering through muslin.

A Problem in Gang Assembling

By H. M. Wilcox*

A progressive study of an interesting assembling job in the manufacture of insulator joints. How observation and a piecework rate developed capacity production and maximum efficiency of presses.

*Mechanical engineer, Miller, Franklin & Co., New York City.

In the process of manufacturing the Jaynes insulating joint the problem was encountered of assembling three malleable-iron castings, a steel washer and five mica washers in two hydraulic presses at a rate to obtain the maximum capacity of the presses.

A cross-section of the assembled joint is shown in Fig. 1. For descriptive purposes the lower casting will be called the tailpiece, the outer casting the shell, and the top casting, the headpiece. The mica washers will be indicated as washers *A*, *B*, *C*, *D*, *E*, starting at the cone-shaped washer located between the flanges of the tailpiece and the shell.

Gaging the Mica Washers

The only preliminary operation on the raw materials before assembling, is the gaging of the mica washers to the proper thickness. The mica is obtained cut in washers of the proper diameters and is gaged in gages made of ¼-in. sheet steel with a slot the proper thickness cut there-

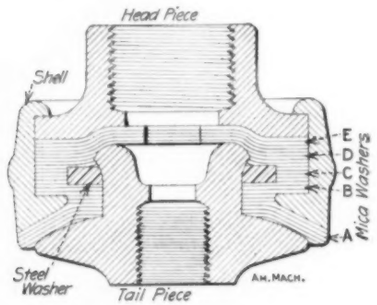


Fig. 1. Cross-section of Joint

in, and the whole set in blocks of wood. After filling a gage, the mica is clipped together with ordinary letter clips and deposited in stock boxes ready for the assembling tables.

The castings are of soft malleable iron, the test required being the flattening of the shells with a hammer without the outer surface cracking. The presses are of 45 and 96 tons maximum capacity and the speed the larger press operates on a working stroke of approximately 2¼ in. is six strokes per minute.

Press Operations

There are four operations in the presses, and but two tools are carried in the tool-holders of each, so that two operations are accomplished on each stroke. Although there are only two points in a joint that require machine work, viz., the riveting of the neck of the tailpiece over the steel washer, accomplished in the small press, and the beading of the upper edge of the shell over the flange of the headpiece, accomplished in the large press, it was deemed advisable to accomplish each of these operations in two stages to eliminate the possibility of granulating the iron and weakening the joint mechanically. Hence the two tools in each press. The first tool in the small press spreads the neck of the tailpiece to an angle of about 45 deg. and the second tool does the riveting. The first tool in the large press shoves down the headpiece, compressing the mica and drawing in the upper edge of the shell to an angle of about 45 deg., and the second tool does the beading.

Hydraulic presses were adopted for this work, rather than presses having a definite length of stroke, as the work itself is used as the stop for the downward stroke, and consequently exactly the same pressure will be applied to each joint in spite of slight variations in the thickness of the mica washers or variations in the length of the castings, thus insuring a uniform run of product. The expense of micrometer-gaging each washer and machining each casting, which would be necessary if the assembling were done in any press of positive length of stroke, is prohibitive and greatly in excess of any saving effected by using presses with a greater number of strokes per minute.

Die and Knockout

The dies in which the joints are assembled, Fig. 2, consist of two parts, the die proper and the knockout. The accompanying diagram shows the cross-section of a die. Three elements had to be considered in the design of the dies, viz., the downward thrust, the bursting effect and the retention of the knockout in the die to facilitate rapid handling. The dies are so proportioned that the downward thrust is taken entirely by the knockout, and in order that there be no splitting action on the die by the shoulder of the knockout which retains it in place in the die, the stem of the knockout is made a trifle longer than the width of the annular ring on the inside of the die.

The downward thrust is thus transmitted directly through the knockout to a hardened-steel plate set on the platen of the presses directly under the tools. The bursting effect is taken by the die itself, and the thickness of the die walls was determined by experiment. A shoulder is left on the outer circumference of the dies, which fits under a stripping plate on the press *B*, Fig. 3, and holds the die in place when the knockout is pushed upward in the press *B*, to eject the assembled joint. Summarizing the foregoing, we find the problem revolves itself into the following operations: 1 Nine parts to be assembled; 2 Four machine operations on each joint; 3 speed required of six strokes per minute to obtain maximum efficiency of presses.

Arrangements of Job Details

The arrangement of machines, stock and operators to accomplish these operations is seen in Fig. 3. The stock, both castings and gaged mica washers (except *A*, Fig. 1, which is handled in 12x18-in. pans) is handled in wooden stock boxes 12-in. wide by 24 in. long by 8 in. deep, inside dimensions, with iron handles on each end. The boxes are numbered

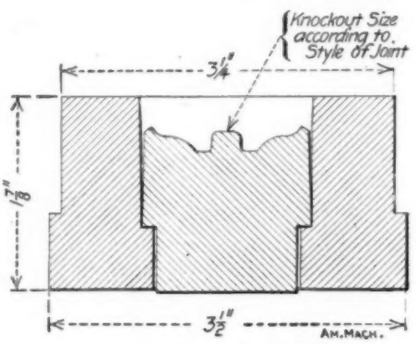


Fig. 2. Die and Knockout

1 to 9 inclusive, and arranged in order on the tables and assembling frames as indicated.

A table, Fig. 4, showing the stock numbers of the castings and washers for each size and style of joint and the box number in which each part belongs for the assembling, simplifies arranging the stock for assembling. The location of each box on the assembling frames and tables is indicated by the numbers painted plainly on the boxes, frames and tables.

Another precaution is taken to make this more or less complicated assembling proposition as nearly foolproof as possible, by painting in corresponding colors each tool-holder on the presses, the ends of the tool shanks and the racks in the toolroom. Red, green, blue and yellow are the colors used for this purpose. Each tool is also marked plainly the size joint for which it is intended.

Assembling Operations

The assembling is divided into two parts, the "building in" and the "assembling." The assembling starts with the

building-in operation, which consists of placing a tailpiece in a die and building in the cone-shaped mica washer *A*. The mica for this washer has a segment of about 40 deg. cut out, and the washer is built up with from six to ten layers of mica, the joints being broken with each layer. As stated, the mica is delivered already gaged to the proper thickness, and the operator simply picks up a washer, removes the clip and builds it in. A small stock of loose mica is on each table to replace broken pieces.

boy located here places the joint on a tray and returns the die via the slides to the building-in tables. The joints are grouped 50 in a tray and placed on a truck *X* which can be wheeled out of the way when full. An extra box of stock is kept on hand at each point so that there will never be any delay due to shortage of materials.

Gang Assembling Developments

As it was necessary to get the plant operating as soon as possible, and as

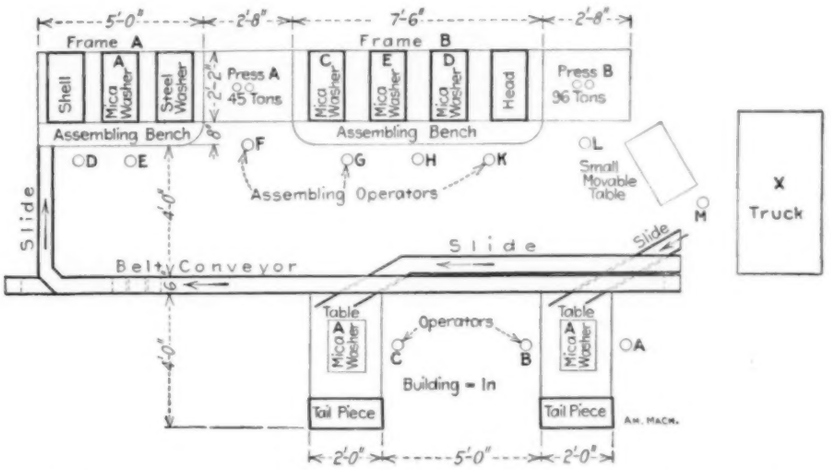


FIG. 3. ARRANGEMENT OF MACHINES AND OPERATORS IN GANG ASSEMBLING

The die with the tailpiece and washer *A*, is then placed on the belt-conveyor, and delivered to the first assembling boy. Two assembling boys place the shell, washer *B* and the steel washer in the die; it is then passed to the pressman at the press *A*, Fig. 3. After spreading and riveting the neck of the tailpiece, the die is passed to the assembling boy at the right of this press, who inserts washer

much depended on the team work of the gang, it was thought best to start gang assembling and study the operation as a whole rather than to make a detailed study of the time elements of each separate operation.

Work was started with operators *A*, *F* and *L*, Fig. 3, the two pressmen, and one girl building-in. The pressmen did all the assembling. A production of 500 joints

Size of Joint		FRAME A Box 1 Tail Casting	Box 2 Cone Mica Washer	Box 3 Shell Casting	Box 4 Flat Mica Washer	Box 5 Iron Washer	FRAME B Box 6 Narrow Mica Washer	Box 7 Thin Mica Washer	Box 8 Dipped Mica Washer	Box 9 Head Casting
3/8" x 3/8"	C	5 C	511	51	512	15	513	515	514	35
	E	5 E	511	51	512	15	513	515	516	31
3/8" x 1/4"	C	6 C	621	62	622	16	623	625	624	36
	E	6 E	621	62	622	16	623	625	626	32
3/8" x 3/8"	C	7 C	731	73	732	17	733	735	734	37
	E	7 E	731	73	732	17	733	735	736	33
1/2" x 1/8"	C	6 C	621	62	622	16	623	625	624	×46
	E	6 E	621	62	622	16	623	625	626	×42
1/2" x 1/4"	C	6 C	621	62	622	16	623	625	624	46
	E	6 E	621	62	622	16	623	625	626	42
1/2" x 3/8"	C	7 C	731	73	732	17	733	735	734	47
	E	7 E	731	73	732	17	733	735	736	43
1/2" x 1/2"	C	8 C	841	84	842	18	843	845	844	48
	E	8 E	841	84	842	18	843	845	846	44

C = Combination (Gas) and Electric Joint. E = Straight Electric Joint.

FIG. 4. TABLE SIMPLIFYING ARRANGEMENT OF STOCK

C; two more assembling boys place washers *D* and *E*, and the headpiece in the joint and pass this to the pressman on press *B*.

Here the swaging and beading operations are accomplished and the assembled joint knocked out of the die by a hydraulic knockout extending up through the platen of the press. The last pressman passes the die and knockout to a small movable table on his right and a

per day (working day of ten hours) was obtained, but the girl building-in was idle about half the time and the dies bunched up between operators *F* and *L*. The operators were paid straight hourly wages during the development period.

The assembling boy *H*, was then put on, and the production increased to 800 per day. The dies started bunching to the left of *F*, who could not quite keep up assembling parts *C*, *D* and *E*, and operate press *A*. The assembling boy, *D* was then put on but the production increased very little as *L* and *A* seemed to be working nearly up to capacity. Consequently, another building-in girl *B*, and the boy *E*, to return the dies from *L* to the building-in tables, were added.

This gang averaged between 1500 and 1600 pieces per day for several days and then the operator of press *B*, who had been made gang boss, complained that the dies were not coming fast enough from the building-in girls. Operator *D* also seemed to have plenty of time to look out of the window and make himself generally sociable. Another girl for building-in operator *C* was added, and at this time a detailed time-study of the building-in operation was made to determine a piece-work rate.

The building-in operation was divided into five elements, viz: Picking up die and placing in position; picking up mica washer; removing clip and dropping in box; building-in mica washer; picking up die and placing on belt conveyor.

Piece-work Scale Jumps Production

From an analysis of the data secured by this time-study, it was determined that the building-in operation could be accomplished at the rate of two per minute or 1200 per day. However, it takes considerable finger pressure in building-in the mica washers, so the element of fatigue had to be considered, and a rate was set on the basis of 1000 pieces of work per day per operator. The girls on building-in had been earning $1 per day, and as noted above, it had been necessary to put on a third girl to keep up a steady production of from 1500 to 1600 per day.

A piece-work rate of $1.20 per 1000 was set and put into effect at noon one day, when one of the building-in girls had gone home. About an hour after starting the afternoon run the building-in operators *A* and *B* were calling for more work. The assembling gang could not keep them busy, the clogging occurred at assembling boy *H*. The next day assembling boy *G* was put on and the production immediately jumped up to 2000 per day.

This production held up in good shape but in a very short time the electrical loss in the testing room began to increase, evidently through carelessness in the assembling gang. The building-in operation is of such a nature that it is practically impossible not to do it correctly, and investigation indicated that the bad results were being caused by the occasional omission of a washer when the work was coming through fast.

To eliminate this a bonus of 10c. per hundred on all joints over 1000 per day was established, the bonus payment being based only on joints which passed the electrical tests. The total bonus for a week's run was divided equally among the

hands in the assembling gang, regardless of the rate of wages paid each hand individually. The product immediately improved in quality under this system, which also acted as a spur to keep up the output.

PRODUCTION AND EFFICIENCY INCREASE

The entire force now worked as a well balanced unit, but the production of 2000 per day was only about 56 per cent. of the total capacity of the presses, the pressmen being able to handle a greater number through the presses and utilizing part of their time assisting in the assembling. Consequently, a third girl *C*, was added to the building-in gang and two assembling boys, *E* and *K*, were added to the assembling gang. A production of 3000 pieces of work per day, and an efficiency of 83⅓ per cent. of the total capacity of the presses was thus secured.

This gang of eleven hands was not quite as well balanced as a gang of eight hands with a production of 2000 pieces per day, and it was found expedient to operate a greater part of the time on the latter production.

In addition to the actual mechanical operations in this gang assembling the personality of the operators making up the gang, was an important factor, and a considerable amount of experimenting had to be done in trying out hands to eliminate the "individualist" and to secure those having a capacity for team work.

Milling Work in the Screw Machine

BY S. NEVIN BACON

It is commonly known that milling attachments are frequently utilized in connection with automatic screw machines, but very little has been written on the subject to describe just how these attachments are used and the variety of cuts which can be made. The accompanying diagrams show some examples of work in which the milling cuts were made automatically and in unusual location for operations performed on the screw machine.

The piece shown in Fig. 1, besides having the two holes drilled, also has the slot *A A* milled complete in one chucking from the bar in a Brown & Sharpe No. 2 automatic screw machine. The slot is milled with a cutter, similar to a reamer, which is secured in a holder, Fig. 2, mounted in a bearing on the front slide of the machine, and driven by a grooved pulley which takes a round belt with sufficient slack to allow the required movement of the front slide.

When the piece is ready to have the slot milled the spindle is stopped by shifting the driving-pulley clutch to one of the driving pulleys which has a loose belt; at the same time a pin in the chuck cap comes in contact with a block on the front slide, which has now moved forward to mill the slot as far as the center of the work, at which point the stop pin is released to allow the loose belt to revolve the spindle part way (see Fig. 1, angle *B*) when the front slide again moves forward and the cut is finished. The cutter which is rotating all the while is held in this position until the piece has been cut off, when the front cam allows it to drop back. A simple cut made in the same manner is shown by Fig. 3.

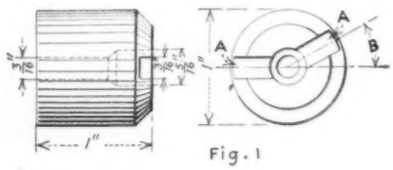


Fig. 1

Fig. 3

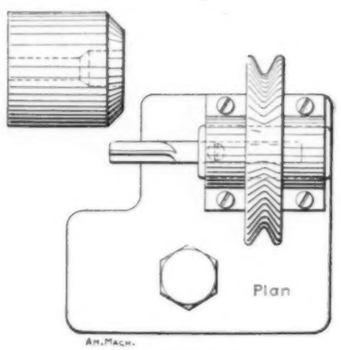


Fig. 2

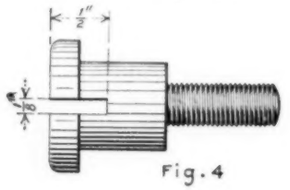


Fig. 4

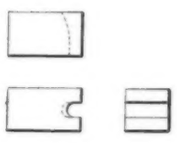


Fig. 5

MILLING WORK IN THE SCREW MACHINE

As it may be useful to many to know how heavy a cut may be taken by using the slotting attachment a sectional view of a large screw slotted in a Brown & Sharpe No. 2 automatic screw machine is shown in Fig. 4. The standard slotting attachment was used and the cut was so heavy as to require a flat belt pulley to replace the round belted one. Under these conditions the milling shown was made successfully without any loss of time as it was slotted during the other operations.

A very interesting job is shown in Fig. 5. This consists of a slot milled in the end of a square piece, the slot being milled on a curve. The method of making the cut is similar to that described in connection with Fig. 1 except that it is not necessary to index the spindle. Milling on a curve is accomplished by having about ⅛ inch forward movement in the holder which carries the milling cutter and for every fraction of an inch forward feed of the cutter by the front-slide cam we have an equal amount of longitudinal feed by the lead cam, which operates a stop in the turret, this stop pushing against the holder. After the cut is made and the turret has withdrawn, the cutter is returned by a spring which is mounted on the holder.

Making a Prime Number Wheel

BY ERNEST A. HORNE

Having to make a wheel a little while ago with 109 teeth and not having a differential head, we tried the following method, and got excellent results.

We used the ordinary dividing head on a miller, sized the blank for the number of teeth required, cut one-half of the wheel at the rate of 110 and the other half at the rate of 108, which gave us 109 teeth. Being fully aware of the error, we then geared up to cut another from that one, on the automatic gear cutter, and were agreeably surprised to find that the tooth error in the No. 2 wheel was not greater than 0.002 in.

We then destroyed the one cut on the miller. In both cases, the pitch was 12 diametral pitch. Since then we have obtained the same results in other change wheels of prime numbers.

Great attention is just now being given to the quality of steel rails, and justly so. Yet only a fraction of 1 per cent. of broken rails cause any disaster. On the better class of railways, the tendency is for a constantly improving track and road bed. And because of the attention given to structures and the "bigger things," there are now two derailments due to defective equipment to one due to defect of track. In view of this fact, it is not the part of wisdom to make price the controlling factor in buying the various appliances which enter into modern car and locomotive construction. The money saved in the first instance is more than lost in the necessity of additional cost of maintenance.—*The Railway and Engineering Review.*

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Troublesome Gating for Brass Valve Bodies, Stems and Nuts

Our brass foundry had, among other troubles, a high percentage of bad castings, running anywhere from 10 to 25 per cent. It was therefore decided to make a thorough inspection, and find, if possible, where the fault lay.

We first inspected the sand. This seemed as good as could be had. Then metal mixtures, the various fluxes and cores were looked into. Some changes in core mixtures were made, and the ovens attended to night and day. This lowered the percentage to from 5 to 15 per cent.

As the plant had been running only a few years, the patterns were all new, but these were also carefully inspected. Nearly all patterns were brass or iron, mounted on solid plates, with stripping plates to match. A few were fixed up. The dowel pins were found to be all right.

A two months' test was given, but the results were far from satisfactory, so the gating of the patterns was gone over. After the alteration of nearly every pattern plate, and a test of more than five months, the percentage of bad castings has dropped an average of 4¼ per cent.

The diagrams show only the positions of the patterns which were found to be satisfactory; also various other methods in common use and their disadvantages. Fig. 1 represents nuts, whose patterns make their own cores, and sprues mounted on the plate. On the *A* side of the plate are shown three poor ways of arrangement. The position of the sprue at *a* makes the metal in pouring flow against the core. This was found to wash part of the core away. At *b* the metal not only washed part of the core away, but more time is required to grind the metal on the sides of the hexagons.

The position of the sprue is bad, as the metal in pouring (if all were gated the same) would have a tendency to flow first into the top mold and choke up the gate by cooling the metal. The lower mold would therefore either have bad castings or be left entirely blank. Foreign matter, which could not rise because the gate was choked by metal entering the top molds, was also found in some of the lower castings.

Twenty-five per cent. of the castings from *c* were found to be bad, because the bulk of the metal in pouring would flow to the bottom of the gate, while a little would cool at *c*. Thus, when the metal forced its way to the top molds, the casting had a line where the metal did not meet properly.

At the *B* side of the plate, the metal flowed to the bottom, where all foreign matter settled at *d*. Then, as the metal rose, it filled the lower molds first, giving each casting metal alike. The position of the sprues allowed the metal to flow around the cores, as shown at *e*, thus avoiding breakage of cores.

Valve bodies are seen in Fig. 2. The sprues at *e*, *f* and *g* were hard to cut on the sprue cutter, owing to the angle of the casting, while on *a*, *b* and *c*, castings the faces of the hexagon had to be ground, as shown at *y*. The section of the sprue at *aa* was found to give the molders less trouble than as shown at *bb*, owing to the round corners on the former and the sharp corners on the latter. The metal at *a* and *c* flowed against the core and did not flow evenly through the body, the diaphragm being too far away from the sprue.

At *j* trouble was experienced as stated at *c*, Fig. 1. At *k*, the position of the sprue is bad, and the gate is likely to become choked up as in *b*, Fig. 1. The mold at *h* was found to be in the best position, as the metal flowed evenly around the diaphragm. This position of the bodies reduced the percentage a great deal, as the valve bodies gave us the most trouble.

Valve stems are seen in Fig. 3. The position of the sprues at *a* has the same disadvantage as at *k*, Fig. 2. Furthermore, as the top of the stem is small, it gives very poor passageway for the metal. *b* has the same disadvantages as at *j*, Fig. 2. *c* has two faults: First, the same as at *a*; second, it is hard to cut on the sprue cutter. *d* also has this bad feature. While at *e* and *f* the sprue is properly gated, it costs more on the cutting operation. *g* was found to give the best satisfaction, with the lowest percentage of bad castings.

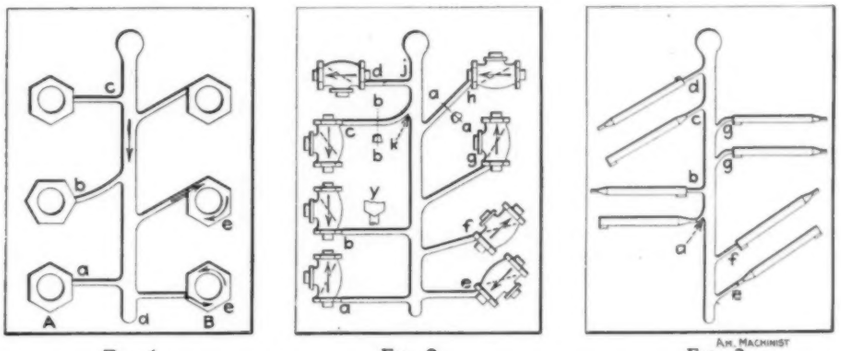


FIG. 1 FIG. 2 FIG. 3

GATINGS FOR BRASS NUTS, VALVE BODIES AND STEMS

J. H. CHESTHAM.

Cincinnati, Ohio.

Grinding Keyseater Cutters

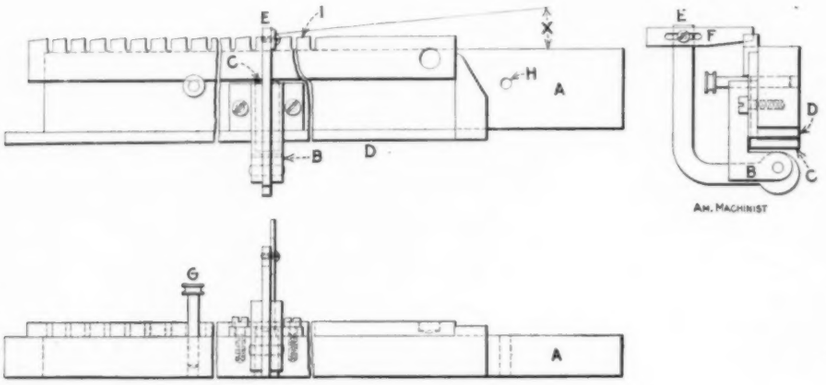
I had a large number of keyseater cutters, of the type shown in the cut, to sharpen. These had always been ground by holding on a cutter grinder by hand and grinding only the teeth that were dull.

They were usually used on thin pieces and did most of their cutting in the center, and, consequently, when I measured them, I found some were $\frac{1}{64}$-in. narrower there than at the ends.

These cutters were about 18 in. long and were found by trial to work best when given a taper of about $\frac{1}{32}$ in. in that distance. As it was my duty to rig up and grind them that way, I made the fixture shown.

A flat piece of cast iron, planed all over, and bolted on the table of the cutter grinder so that it is flush with the edge of the table nearest the wheel, is shown at *A*. The table is then swiveled to get the angle *X*, which is the clearance desired on teeth. Bolted to *A* is a bracket *B*, which carries the lever *E*, and also acts as a cap or guide for a small angle-shaped gage *C*, which freely slides in and out under it.

One end of *E* is made eccentric, so that when thrown back it locks the gage piece *C* against *D;* the other end carries a gage *F,* which engages with the teeth of the cutter to be ground. *D* is a taper piece slightly longer than the cutter, with one end bent so that the end of the cutter carries it along when moved to grind the next tooth. This end of *D* is $\frac{1}{32}$ in. thinner than the other, or just the clearance desired on the cutter.



FIXTURE FOR GRINDING KEYSEATER CUTTER

To operate, place the pin *G* in the hole, as shown, bring the front of the tooth *I* against the gage *F,* which also places cutting edge in line with the point of the gage *C,* against which it must be drawn; next slide *D* along until the end touches the cutter, then pull the lever *E* back, thereby locking *C* and *D* against *A.*

We now have three solid points, *G, C* and *D,* to locate the cutter. The tooth *I* is fed past the face of the cup wheel by moving the table of the grinder. To grind, the next tooth *E* is again swung forward, releasing *D,* and the cutter is moved to bring the next tooth against *F;* it carries *D* along with it where it is locked, and the tooth is ground in a similar manner to that previously described.

As the taper piece *D* is fed along, it gradually gets thicker, thereby causing the gage *C* to be slightly receded for each succeeding tooth. When the cutter has been about half ground, pin *G* is taken out and put in the hole *H,* which is placed about $\frac{1}{64}$ in. back of the line of the other hole and the gage piece *C;* this is to allow for the taper, but does not need to be accurate, as the grinding is done directly in front of the gage *C,* and any variation in the location of *H* would only mean a difference in clearance and not in taper.

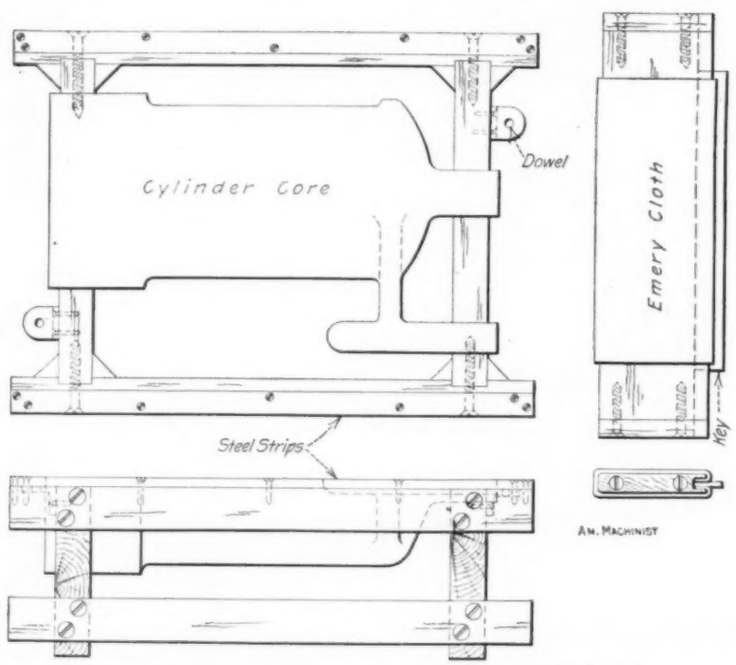
When the cutters are nearly worn out, they develop quite a bow, owing to the way they are held against the work in the keyseater. This fixture takes care of that by doing the grinding directly in front of the gaging point.

Rochester, N. Y. M. V. D.

A Jig to Insure Accurate Rubbing and Pasting of Half Cores

A jig for holding a cylinder, water jacket and other cores to insure accurate rubbing and pasting on the two half cores is shown in the diagram. Only half the cylinder core and jig is shown.

The jig is a rectangular frame having ends and sides, with no top or bottom; the material is cherry wood dressed to 1¾ in. thickness, which are securely glued and screwed together and strengthened with corner pieces as shown.



JIG FOR ACCURATELY RUBBING AND PASTING HALF CORES

Half circles are cut out of the end pieces to receive the print ends of the half core; strips of steel ⅛x1 in. are fastened to the face of the jig with screws; angle irons having holes in one pair and dowel pins in the other pair are screwed to the ends as shown.

The rubbing of the core is done by means of a sheet of emery cloth wrapped around a cherry board 1 in. thick and having a saw groove cut lengthwise in the edge to receive a metal strip or key; the construction of this board is clearly shown.

The half core is placed in the frame and should touch practically every point in the half circles. This is very important, and it is for this reason that the cores project beyond the ends of the jig, thus making everything clear to view.

The ends of the rubbing block rest on the steel plates, but the emery cloth is only a half inch wider than the largest diameter of the core, consequently there is no necessity for hardened parts. There are no pockets in the jig or flat surfaces to catch and hold the loosened sand. The jig is inexpensive and the operation is simple and foolproof. Furthermore, it is a guard against careless or hasty work in the coreroom.

The drag half of the jig is placed on the pasting bench, the core is placed in it and the joint face rubbed by drawing the rubbing block back and forth until the ends rest on the steel plates; next the half jig with the half core is removed from the pasting bench to the inspecting stand. This stand or table is made high enough so that the inspection of the cores, when put together, is easily and conveniently done by the core maker and with only a slight bending of the body.

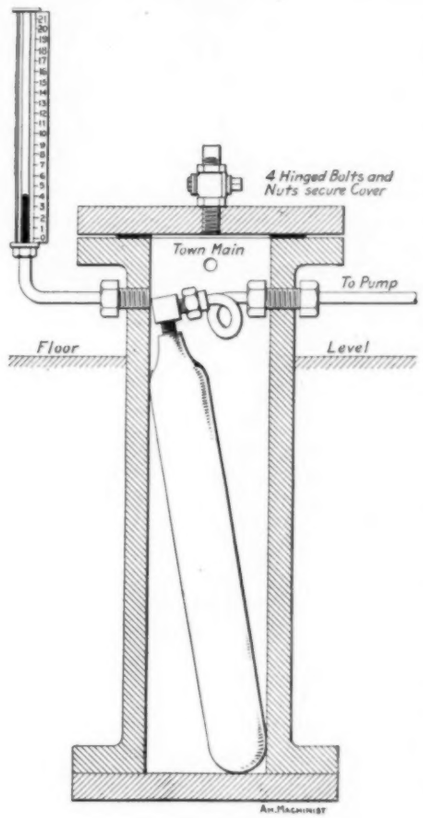
After this the other, or cope half, is put through the rubbing operation; then the jig with the core is placed on top of the first, or drag half, and both accurately and firmly held in position by means of the dowel pins.

An inspection is now made to see if the cores and the steel plates come together. The top half is then lifted, paste is applied to the joints and the half returned for a final inspection and binding of the two halves together by means of wire wrapped around the protuding ends of the core.

Kenosha, Wis. DAN. COX.

Testing Compressed Gas Flasks

Refrigerating machines using CO_2 as a medium for the elimination of heat have become general in England. As supplied the gas is in liquid form in steel flasks made from drawn tube $\frac{1}{16}$ in. in thickness; one end of the flask is necked to receive



APPARATUS USED IN TESTING FLASKS

valve, the other is welded to hemispherical form.

Certain precautions are essential to the handling of the flasks, and the necessity for stringent regulations and tests is apparent from an accident which occurred several years ago when a man and cylinder were blown to atoms at a railway station. Subsequent to this, a commission sat and its findings were incorporated in the form of a report and recommendations concerning manufactured material, annealing and tests of finished flasks.

With regard to empty flasks, sufficient care is even now not exercised. For instance, it has been known that empty flasks were used as rollers in moving heavy machinery. This misuse should be legally discouraged as the flasks in course of time are refilled and the stresses set up by such mishandling may have disastrous results.

The usual quantity of CO_2 in a flask is $\frac{3}{4}$ lb. for each one pound water capacity. If flasks have to pass through the tropics the quantity is reduced 25 per cent. An increase in temperature from 65 deg. to 100 deg. F. increases the pressure about 1000 lb. per square inch. One purchaser of filled flasks for export through the tropics specifies 1800 lb. per square inch as the maximum when filled.

Most large buyers of filled flasks use specifications based upon the findings of the 1896 Commission. The principal clauses insisted on are as follows: 1. Flasks are to be made of the best quality mild steel containing not more than 0.25 per cent. carbon and not less than 99 per cent. iron. 2. Flasks are to be hydraulically tested to a pressure of 3360 lb. per square inch and are not to show a permanent stretch or enlargement of their cubic capacity of more than 10 per cent. of temporary stretch under test.

Clause 2 is rather puzzling at first sight; the method and apparatus used for the stretch that will prove of interest. The diagram shows the apparatus used. This consists of a cast-iron cylinder partially sunk below the floor level and having a connection to a glass tube with scale attached on one side and a connection to the pump on the other.

The pump connection terminates in a nipple inside the cylinder. A cast-iron cover pointed with a sheet packing ring provided with a cock, completes the outfit. An ordinary hydraulic hand pump is used. Water for filling the cylinder is from the street main through the connection shown.

The flask to be tested is filled and lowered into the cylinder. A short length of copper pipe with two unions makes the connection from the pump nipple to the flask. The cylinder is then filled from the main and the cover jointed on. Additional water is run in until the graduated tube shows zero, then the water-main connection is shut off.

Next the flask is pumped up to the 3360 lb. pressure by gage. The water level in the tube now shows an increase from zero to say division 20. The pressure on the flask is released, the level in the tube dropping simultaneously. The permanent set is shown as the difference between the zero and the final level and its percentage of the maximum is easily ascertained.

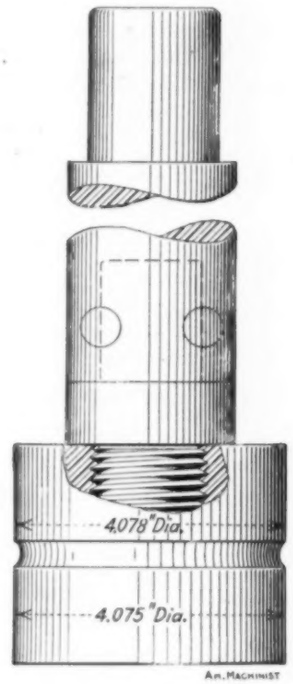
With one man filling flasks and two more attending to the apparatus 30 flasks an hour are easily handled. The apparatus as will be seen makes full provision against imprisoned air which would render the test unreliable.

London, England. A. L. HAAS.

Dies for Making Strawboard Slip Covers

A description of a set of dies to make slip covers from wood or strawboard should be of interest. The dies are for a double-acting press and are noteworthy owing to the sizes of the die parts, the allowances being contrary to what would be thought necessary by anyone not accustomed to this work. The floating punch is also something of a novelty.

The dies were to make a slip cover to fit a body made on a 4-in. mandrel, the flange to be $\frac{1}{2}$ in. deep. As the paper lengthens but little in the operation this would be a cut edge of 5 in. The body of the can is made of two-ply board 0.02 in. thick; this gives an outside diameter to the body of 4.08 in., we subtract 0.006 in. from this for the punch diameter which would be 4.075 in. for the inside diameter of the draw ring, we add one thickness of material 0.02 in. and



A FLOATING PUNCH

0.006 in. to the punch diameter making 4.101 in.

The top inside edge of the draw ring is rounded $\frac{1}{8}$ in. radius and knurled with a coarse knurl. This knurling, while adding to the appearance of the cover, prevents the outer skin of the paper from puffing or blistering; the ring is left dead hard and very smooth.

The punch is double ended, one end being 0.003 in. larger than the size given above. This large end is used when the draw ring is worn, and also if a roll of paper happens to be thin. The punch also must be dead hard and very smooth.

The punch shank is made in two pieces, as shown in the cut. It has a movement

parallel with the plane of the die of 0.004 in., this permits the punch to adjust itself to any variation in the thickness of the stock. The value of this floating punch over a stationary one is seen in the decrease of spoils.

The press bolster plate is cored for steam heating, the die while in use having a temperature of about 140 deg. The paper is dampened before using, the correct amount of moisture in the stock being very important. These dies with an automatic feed will make 175 covers per minute.

W. AYRES.

Hamilton, Ontario, Canada.

A Ball-Turning Lathe Fixture

Some time ago I had occasion to machine a large number of steering arms similar to that shown. With the equipment on hand and the time restrictions, the ball ends presented a problem. After experimenting with formed cutters on the profiler, and formed tools on the engine lathe, it was apparent that some other method must be adopted if true balls were to be turned in a reasonable time. Furthermore, the forgings were not up to standard, which added to our difficulty.

By referring to the illustration of the arm, it will be noted that there is very little room to spare, the knuckle end projecting in such a way, when in a lathe, as to prevent getting a 180-deg. swing for the fixture. For this reason the fixture shown was made, and set to work with but one change, that was the stop *L*, which was added after the first tryout. The results were both satisfactory and interesting.

Referring to the illustration, *A* is a cast-iron plate, upon which is mounted the cast-iron block *B*, which is held in place by the taper bolt *K* and the block *J*, allowing it to swing on *A*. *J* is babbitted to fit the V-groove in *A*. Upon *B* is mounted and held in place with a stud in the hole *j*, a machine-steel block or tool holder *C*. The tool, ⅜x⅜-in. high-speed steel, is inserted in the slot *o*, under which is the rocker shoe *D*, the tool being clamped by setscrews in the holes *m*.

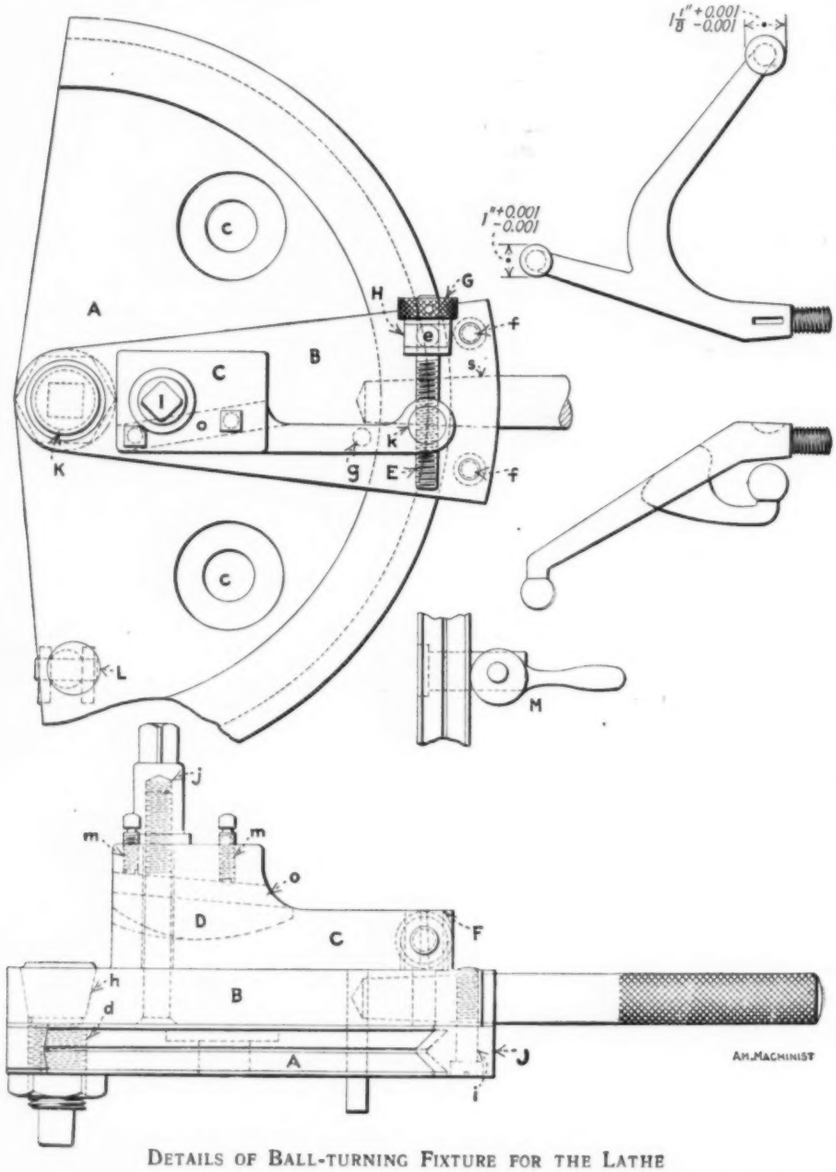
Into the hole *k*, block *C*, is inserted the nut *F*. *H* is slipped on the screw *E* and held there with the knurled collar *G*, which is pinned on the outside end. *E* is then screwed into the nut *F*. The block *C* is slipped over the stud, *H* entering the hole *e* in *B*. This provides for adjustment for the diameter. Vertical adjustment is obtained by setscrews and the rocker *D*. The long cap nut *I* was used to allow room to get at the setscrews.

The piece *J* is fastened to *B* with two fillister screws in the holes *i* and *f*. A pin projects from the bottom of *B* in the hole *g*, which strikes on the eccentric stop *L*. The eccentric stop was put on to hold the size of neck, *L* being held where set by the eccentric lever *M*. Hole *n* in *B* is taper and hole *d* in *A* is tapped, allowing for wear on the stud *K*, a lock nut holding *K* in position. A handle of suitable length is inserted in *B* at *s*. The fixture is clamped to the compound with three-head capscrews in the holes *c*, the compound being swung around parallel with the centers.

To make the circular seat for the rocker *D*, a 5x⅜-in. cutter was run in from the top of the block *c*; then a T-slot was milled near the top of the piece; into this was fitted a piece, which made the top into which the setscrews go. This piece was then pinned and brazed, making it practically one solid block.

This is a substantial, inexpensive fixture which did the job on hand within the limits allowed, removing 1/16 to ¼ in. of stock at the rate of from 15 to 20 per hour, depending upon the quality of the forgings.

Lansing, Mich. R. C. NEVIN.



DETAILS OF BALL-TURNING FIXTURE FOR THE LATHE

Although steel pipe is more extensively used nowadays for general purposes about the steam plant than wrought-iron pipe, many engineers are unable to tell from its appearance whether a length of new pipe is iron or steel, notwithstanding that the distinction is quite marked. Steel pipe is the smoother appearing, and whatever scale it may bear stands out in small blisters, which, when scraped away, reveal a smooth and usually white surface beneath. Iron pipe is generally quite rough, often lacks the even symmetry of steel pipe, and its scale lies in heavy flakes. Steel pipe will stand much flattening without fracture, while iron pipe will not. Also, iron pipe shows a coarse, jagged fracture, by reason of the laminated and fibrous structure of the metal; while a break in steel pipe reveals a fine crystalline grain.—*The National Engineer.*

Discussion of Previous Question

Referring to letters and articles previously published

Plant Repair Cost Records

Having worked in 12 plants, six of which might be classed as large ones, I may reasonably claim to have some knowledge concerning the repair of plants, although I am not prepared to admit that the number of plants worked at is any guarantee that the worker has knowledge.

The above is apropos of the criticism of J. T. T., in Vol. 35, page 1132, wherein he accuses me of "writing from an experience which is narrow and closely circumscribed." I very much fear that J. T. T. did not read my letter on page 512, in the same volume, very closely, because the main idea underlying the "plaint" was not so much a question of keeping a record of costs, as of having, as far as possible, the same man to repair the machine each time. This is very necessary in these days of intricate machinery, where frequent small adjustments are the order, as the best of mechanics would otherwise spend a good deal of time finding out how to tackle the job.

The suggestion that the repair foreman should keep a record of all repairs was offered because, in my experience, it is not done in many large plants. Costs are kept closely enough in many establishments, but invariably in the office, and very often after a lapse of, say, two years, questions are asked as to the alleged excessive amount spent on certain machines.

If the repair foreman kept a record, he could check this before it became excessive, and an investigation would probably result in cutting down the expense. On the other hand, the money is spent before the office realizes that there is undue expenditure.

Quoting from J. T. T.'s article, he says: "The manager's order must be put through, and the order specifies within close limits the extent of the repair." Mentally, one can picture the manager of a busy establishment spending a lot of time over signing D. O.'s for repairs that he knows have, more than likely, been completed; and one wonders, with a previous writer in the AMERICAN MACHINIST: "What happens when the manager is away and the belt comes off?"

Moreover, how can the extent of the repair be certified until someone has dismantled the machine? With regard to the statement that "the order specifies within close limits, etc.," the following is to the point:

A certain cost branch sent down to the shop and inquired why $\frac{1}{16}$-in. screws had been used when the departmental order clearly specified that they were to be 0.312 inch.

I can modestly claim to have more than a nodding acquaintance with organization and system, with their attendant piece, route and store cards, cost slips, departmental orders, etc., and it is my firm belief that these latter complicate rather than simplify the difficulties encountered.

This must not be taken as an adverse criticism of system, as I have a wholesome belief in, and a growing admiration for, systems that attain the ends for which they were designed. But the installation of a system, cost or otherwise, with its mass of cards, is no guarantee of effective or efficient organization.

I quite agree with J. T. T. that managers today are very keen, but the man to watch machine repair costs is the repair foreman, and to do this, he must have his fingers on the pulse of the patient, i.e., he must have the machine records, and as these, in many large plants, are not immediately accessible, the inefficiency spoken of in my previous letter results.

There is no position in a large engineering establishment that requires such a wide experience or such an accurate knowledge of machine tools, coupled with a mature judgment, as that of the repair foreman, and as the best workmen should have the best tools, the repair foreman should have the machine records, or access to them.

London, England. W. GEORGE.

Elimination of Arrowheads

In Vol. 36, page 232, C. W. Reinhardt offers a criticism of the suggestions contained in my article in Vol. 35, page 971, on "Dimensioning Drawings." Several other criticisms of this little article have appeared, indicating that the article attracted far more attention than was expected.

Now as to leaving the arrowheads off, the original article was in error in stating that a pencil drawing is made on which the arrowheads are omitted, being placed on the tracing by the tracer. As a matter of fact the drawings in the shop referred to are made in pencil on white bond paper, and inked in directly. In this case the omission of the arrowheads by the draftsman is no serious matter, as the junction of the dimension lines and dimensions projection lines shows just as clearly as the junction of the object lines. It will be admitted that if the tracer did not know where arrowheads should be added when inking in he would not be worth much to the company employing him.

As regards the omission of the inch marks after dimensions, I surely cannot agree with Mr. Reinhardt that this is a "fatal error." The original article clearly stated that all dimensions under four feet were expressed in inches, and as the shop referred to is engaged exclusively in building jigs, fixtures, etc., a larger dimension is seldom encountered. It is, therefore, certainly a waste of time to add the inch marks to figures which are invariably understood to mean inches just as clearly as full lines are meant to represent visible surfaces, and dotted lines invisible ones. Nor is there the least chance for the workman to think, for instance, that the dimension 36 which might appear on, say, a milling fixture meant feet instead of inches if not followed by marks, as a fixture 36 ft. long would be *some* fixture.

I hope this will make clear that the practices referred to are not so radically different from those in general use, and further, that they are used with great satisfaction in many other shops where I have worked.

Harrisburg, Penn. J. H. PARK.

A Dry Spindle that Ran Cool

Occasionally I look over back numbers of the AMERICAN MACHINIST, and, as a rule, am rewarded with some interesting reading.

In Vol. 35, page 843, I find an article by E. A. Dixie, entitled "Why Did These Bearings Run Hot When Flooded with Oil?" This was very interesting and recalls a matter of running bearings dry.

Some years ago, while working as a tool maker in a watch factory, I had some internal grinding to do and immediately began a search for a traverse grinder for the job. Every tool maker in a watch factory is supplied with a bench lathe instead of a vise; he also has a complete outfit for grinding. In this case I had borrowed my neighbor's grinder, which had just been supplied with new bushings, hardened and lapped, perfectly true, round and in line; the spindle was also lapped true and round.

When I began to grind, I found the bearings would run hot, so hot, in fact, that the spindle would expand in the

bushings and stop running altogether. Finally it was suggested that I run it dry, as another man in the shop had done likewise, with some success.

This was tried; I washed all the oil off carefully with gasoline, then every few minutes wiped the spindle with my hand until all the oil was removed. I found the gasoline would not remove the oil entirely and that the dry hand was the only thing that would do so.

I used the grinder for three days steadily, without oil, wiping the spindle occasionally with my hand to keep it bright and clean. As this was a traverse grinder, I kept the spindle sliding to prevent its running in one place, as I was afraid the bearings would cut if allowed to do this.

I again used the grinder and found that it would run hot with oil and would cool immediately if run dry, and the bearings would reach the temperature of the room; they, in fact, would not even become warm, but would remain as cool as the bed of the lathe.

Mr. Dixie also asks, "Why Did These Bearings Run Hot When Flooded with Oil?" I would ask: Why didn't these bearings run hot when run dry?

Brooklyn, N. Y. ED. DOBBINS.

[W. H. Sawtell wrote, on page 248, Vol. 32, Part 2, of spindles running under similar conditions.—EDITOR.]

Writing on Blueprints

In Vol. 36, page 310, you give a method of writing on blueprints that is new to me. I desire to contribute the simplest and best method that I have learned in sixteen years' service in drafting rooms.

Place a piece of quicklime in water and allow it to slake. The particles of lime will settle at the bottom and by stirring when desired for use it may be made of a consistency to work well in the writing pen or instruments, and will not corrode them.

This makes a clean white lime and as the powdered lime does not cling in the fiber of the paper but, when dry, shakes off by handling the print, there is no unsightly blur from absorbed moisture, or finger contact as is the case with many of the solutions used for this purpose.

S. O. GORDON.

Schenectady, N. Y.

Speed Tables for Each Machine

William Kaufman's article in Vol. 36, page 269, suggesting indicators to determine speeds on driller spindles and other machines, is good, no doubt, but it seems to me that if there was a table giving the different speeds at each machine, it would answer just as well.

Most of the machine-tool builders furnish such a table. The foreman could determine the speed of those machines that did not have a table furnished and make one in a few minutes.

This would apply especially to the small shop, where at times most everyone has occasion to use the different machines, and the foreman has so many things to look after that it is too much for him to follow up every man on a job of this kind. In the large shop there is a man who looks after the drilling department, another for the turning, and so on. In that way the best results are obtained.

To illustrate: A short time ago I had a few pieces to drill. Having a drill-speed table at hand, I knew what speed I wanted, but as I did not know the speed of the driller, it was useless. All I lacked was the table at the machine.

Hartford, Conn. G. F. BROWN.

Making Large Bolts in Quantities

Referring to the article in Vol. 36, page 192, we are much interested in F. J. Anderla's method of making large bolts, and would give him every credit for the time on the job and his method of doing it. However, in our opinion, we consider this method suitable only for making half a dozen such bolts, and these only when required in a great hurry.

We are confident that if Mr. Anderla would look a little further into it, he would find that the cost of material alone, 4 in. square across diagonals, from which he made his bolts, cost him more than he could have bought these bolts for, forged, finished and ready for uses. What he lost was about 5 per cent. in price, and the whole of his time and labor, special tools and shop expenses for something like two or three weeks.

In the making of several hundred bolts of this size, it is a waste of time and money to reduce from bar stock. If he doubts it, let him get a price from any large firm of bolt makers, and he will find out how to save money on repetition work of this kind.

PERCY FORD-SMITH.

Hamilton, Ohio.

Auto Cylinder Explosion

There seems to be a typographical error in Oscar Kohsilk's explanation of an automobile cylinder explosion in Vol. 36, page 431.

The article, in ascribing to nitric acid, high explosive qualities when mixed with gasoline, seems to do the acid an injustice. Mr. Kohsilk doubtless refers to picric acid, which is sometimes used to adulterate the gasoline employed in racing cars. That nitric acid, when mixed with gasoline, would have a disturbing influence upon the interior of an engine cannot be questioned, but the damage would be by corrosion, rather than explosion.

I believe the accident is correctly accounted for by the supposition that the exhaust valve went out of action.

MARTIN F. MITCHELL.

Holyoke, Mass.

The explanation offered by your correspondent in Vol. 36, page 431, in regard to the explosion of an automobile cylinder does not quite satisfy. If, as he states, the exhaust valve had refused to operate, it would be interesting to know how the successive charges of fresh mixture got into the cylinder.

In an ordinary four-cycle automobile engine, if an exhaust vaive should happen to become inoperative just after ignition occurred, the exhaust stroke could do no more than compress the burnt gases back to their original maximum pressure, and they would be blown out through the inlet valve as soon as it opened. This would prevent any fresh mixture being taken in on the suction stroke.

Galion, Ohio. H. H. FREESE.

Micrometer Lines to Accurately Set Dividers

In Vol. 36, page 390, Mr. Homewood expressed an idea relating to this subject. However, I fail to see any office for setting dividers to a micrometer measurement, for if you are to space holes accurately in a piece you will use buttons, in which case dividers, set to an ordinary steel rule, will answer for the preliminary spacing, accuracy being obtained with the buttons. Provided Mr. Homewood has occasion to use such fine adjustment for his dividers possibly he can suggest a method of securing the lines on the micrometers.

Dexter, Me. E. W. TATE.

[Brown & Sharpe have for years made scales with which dividers can be set to thousandths. Any skilled mechanic can easily set dividers to within 0.002 in. of any spacing given on a scale.—EDITOR.]

Among the many advantages which accrue to a man through an increased acquaintance among his fellow engineers, the two that seem to me to be most important are, first, a gain in knowledge from an interchange of ideas, and second, it gives a man a chance to no longer "hide his lamp under a bushel," to quote from an old saying. Many able men are working today in positions of minor importance simply because on account of lack of initiative on their part they have not mingled with other men in their profession, and consequently have not obtained the rating which they, on account of their ability, deserve.—Prof. Miller in *The National Engineer*.

Specifications for Shop Taps*

By A. A. Fuller†

A discussion confined to the considerations of angular diameter and lead—the allowable variations of each and the relation between the two.

In selecting or providing proper taps for shop uses, many qualifications are necessary for a good working tap. The strength, hardness, sharpness, rake and relief, clearance for chips, smoothness of the surface, angular diameter and the lead are important qualities to consider. This article, however, will confine itself to the two last qualities—angular diameter and lead—the allowable variations of each and the relation between the two.

Definitions

By "error in angular diameter" is meant the difference between the actual and theoretical diameters, as measured by a V-thread micrometer, having a conical point on the measuring screw, and a V-anvil at the opposite end of the micrometer.

By "error in lead" is meant the difference between the actual and theoretical measurements of two threads supposed to be one inch apart.

The desirability of uniform tapped holes is so apparent as to need no argument. With uniform tapped holes once established, a variation in the size of the screws, studs or bolts to fit these holes with any degree of tightness desired is a matter quite readily under control. This analysis intends to cover only the most common uses of tapped holes, i.e., those that are intended to receive screws, studs or bolts for binding or holding together parts of a machine or mechanism. These holes should be so nearly alike that for a given length or depth of hole a standard screw-plug gage will fit in all the holes within an allowable tolerance in tightness.

Angular Diameter

Errors in angular diameter are easily comprehended and measured. The effect of an error of this kind is directly the same as an error in the size of a reamed hole, i.e., it causes a variation in the tightness of the fit between the hole and the male member intended to fit the hole. Within practical limits it is independent of the length of the hole, and the amount of variation allowable is inversely as the accuracy required.

*Discussion presented before the New York March monthly meeting of the American Society of Mechanical Engineers.

†Superintendent, Providence Engineering Co., Providence, R. I.

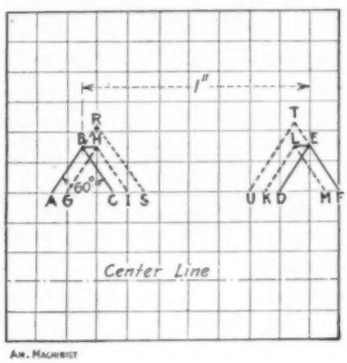


Fig. 1. Errors in Lead

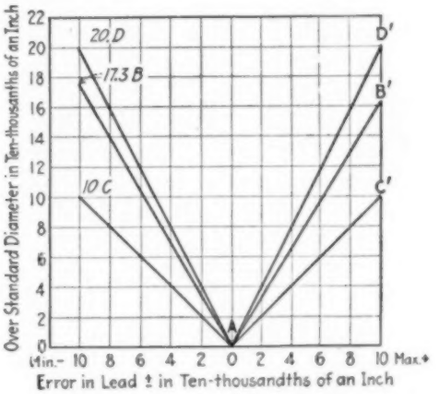

20 D
17.3 B
10 C
D'
B'
C'
A
Over Standard Diameter in Ten-thousanths of an Inch
Min.- 10 8 6 4 2 0 2 4 6 8 10 Max.+
Error in Lead ± in Ten-thousandths of an Inch

Fig. 2. Relations between Diameter and Lead

Lead

Errors in lead are not so easily measured except by special machines constructed for this purpose, such as the one made by the Brown & Sharpe Manufacturing Co. The effect of an error in lead is not direct. Both plus errors and minus errors produce the same effect as far as the fit of our standard plug is concerned, the practical effect of any error being a reduction in the size of the tapped hole; i.e., our standard screw plug will not enter the hole the required depth.

Moreover, the amount of reduction is dependent on the depth of the hole tapped. For a 60-deg. thread and a hole 1 in. deep it has a greater proportional influence on the diameter of the hole than the angular diameter—0.058-in. error in lead equaling 0.100-in. error in the angular diameter.

The allowable variation in lead is dependent on the depth of the hole: For a short hole more error is allowable than a deep hole; but as it is more difficult to tap a long hole with less error than a short hole, it is better to adhere by varying the angular diameter.

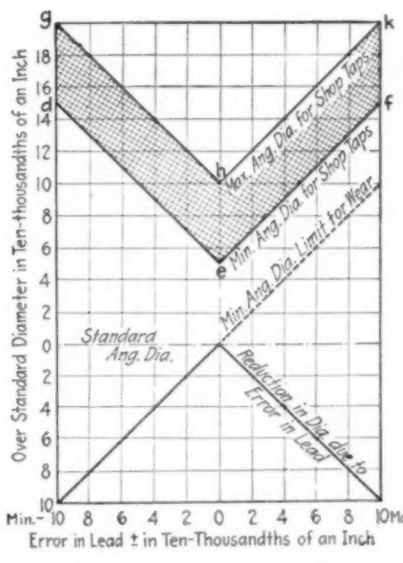

g
k
d
f
b
e
Max. Ang. Dia. for Shop Taps
Min. Ang. Dia. for Shop Taps
Min. Ang. Dia. Limit for Wear
Standard Ang. Dia.
Reduction in Dia. due to Error in Lead
Over Standard Diameter in Ten-thousandths of an Inch
Min.- 10 8 6 4 2 0 2 4 6 8 10 Max.+
Error in Lead ± in Ten-Thousandths of an Inch

Fig. 3. For Errors of 0.0005 In.

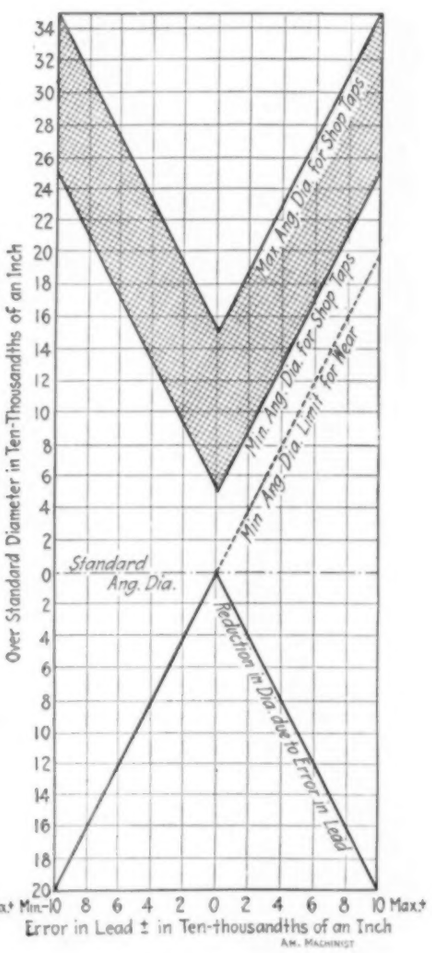

Max. Ang. Dia. for Shop Taps
Min. Ang. Dia. for Shop Taps
Min. Ang. Dia. Limit for Wear
Standard Ang. Dia.
Reduction in Dia. due to Error in Lead
Over Standard Diameter in Ten-Thousandths of an Inch
Min.- 10 8 6 4 2 0 2 4 6 8 10 Max.+
Error in Lead ± in Ten-thousandths of an Inch
Am. Machinist

Fig. 4. For Errors of 0.001 In.

Relation of Angular Diameter to Lead

Referring to Fig. 1. Let *ABC* and *DEF* represent the theoretical position of spaces 1 in. apart cut by a tap with correct lead. Let *GHI* and *KLM* represent two actual spaces cut by a similar tap with an error in lead equal to $BH + LE$. Then the stock *ABHG* and *LMEF* would interfere with the entrance of a standard screw plug.

In order to remove this stock with a tap having the same error in lead it would be necessary to increase its radius by the amount *RH*. The new spaces then cut would be represented by *ARS* and *UTF*, and the standard plug would bear along the surface *AR*, as far as *B*, and along the surface *FT*, as far as *E*.

$$RH = \text{increase in radius}$$

$$2\,RH = \text{increase in diameter}$$

$$BH = LE$$

$$BH + LE = 2\,BH = \text{error in lead}$$

$$\frac{BH}{RH} = \tan. 30^\circ = 0.577, \text{ say } 0.58$$

$$BH = RH \tan. 30^\circ$$

$$BH = 0.58\,RH, \text{ or } 2\,RH = \frac{2\,BH}{0.58}$$

$$\text{Increase in diameter} = \frac{\text{Error in lead}}{0.58}$$

In Fig. 2 the line *BAB'* represents this relationship. If the depth of the hole is less than 1 in. it is only necessary to correct the diameter proportionally. On account of the lack of bearing, an error in lead is more objectionable than an error in angular diameter. If we assume an allowable tolerance of lead of + 0.001 in. to the inch, then for a hole 0.58 in. deep an increase of 0.001 in. in diameter would just compensate for this error. The line *CAC'* would represent the relation between error in lead and increase in diameter necessary to keep the hole standard for a depth of 0.58 inch.

In practice it is desirable to have the taps slightly larger than standard. We can, therefore, move this line bodily upward a distance corresponding to 0.0005 in. and assume this line to represent the relation between the error in lead and the *minimum* allowable angular diameter, as shown in Fig. 3 by the line *DEF*.

Now, if we establish a tolerance on diameter of 0.0005 in. above this, we have the line *GHK*, representing relation between error in lead and *maximum* allowable angular diameter. The shaded area between these two lines represents the zone of allowable tolerance in lead and angular diameter that will produce tapped holes 0.58 in. deep within a variation of 0.0005 in. for practical running diameter.

Without introducing any very great error we may allow this zone to stand for all holes under $\frac{1}{2}$ in. in depth, averaging, say $\frac{3}{8}$ to $\frac{5}{8}$ in. deep. This zone was adopted as a basis for inspecting all taps for holes under $\frac{5}{8}$ in. deep. Commercial taps passing this inspection were designated as Class No. 1.

By similar reasoning, the increase in angular diameter to compensate for the "error in lead" for a hole *over* 1 in. in length must be greater than that for one 1 in. long, and for a hole 1.16 in. deep an increase of 0.002 in. in angular diameter would have to be made to compensate for an error in lead equal to 0.001 in. to the inch, as before.

Assuming this as a standard, then in Fig. 2, the line *DAD'* would represent the relation between the error in lead and increase in the angular diameter to exactly compensate for it on all holes 1.16 in. deep.

Raising a tolerance of 0.001 in., we have in Fig. 4 a zone representing inspection limits applying to taps to be used on holes $\frac{1}{2}$ to $1\frac{1}{4}$ in. deep without introducing serious errors. Taps passing this inspection are designated as Class No. 2.

Usually the diameter of the taps advances with the depth of the hole; Class No. 2 usually covers larger taps than Class No. 1. In like manner other classes could be established for deeper holes, or for the same depth of holes with larger or smaller tolerances. The only practical objection would be the difficulty of keeping them classified in the toolroom and keeping track of them in the shop.

National Metal Trades Association Convention

The 14th Annual Convention of the National Metal Trades Association, held in New York on April 11 at the Hotel Astor, was remarkable for its scope and particularly for the systematic and rapid dispatch of the business of the meeting. The commissioner, Robert Wuest, certainly qualified for a position in the front rank of efficiency engineers and set an example which can well be followed by other associations.

The convention lasted but one day instead of two as heretofore, but by beginning at 9 a.m. and keeping to schedule, the whole program was carried through and without any appearance of undue haste.

Commissioner Wuest's report advocated the establishment of a National Employers' Council. It also discussed the questions of education and legislation, and showed a total of 733 members of the association.

The reports of committees included "Systematic Compensation for Industrial Accidents," by Henry D. Sharpe, and "Industrial Education," by Fred A. Geier. Both subjects are receiving careful attention, and much progress has been made.

The problem of compensation for accidental injury is being considered by most of the states, many already having laws regarding it, with the probability that before the next annual meeting over 20 states will have compulsory-compensation laws.

Industrial education is also growing, the part-time and continuation plans being in favor in several places. Public school boards are being interested and the work is being carried on in various ways. Mr. Geier and Mr. Prosser both spoke of the value of this education in making better workmen, in producing men well suited for foremen and also in preventing boys from dropping out of the trade after a few years.

Prof. Talbot, editor of *Human Engineering*, gave interesting statistics regarding the loss from sickness as well as accidents. He gave medical opinions showing that at least 25 per cent. of this was preventable. This loss falls on employers, as well as on employees and the community in general.

The Page Bill, now before Congress, which provides for an expenditure of about fourteen and one-half million dollars a year for vocational training, was endorsed by the convention.

Promptly at 2 p.m. the afternoon session was opened by H. S. Doolittle, the safety inspector of the association, with a paper and slides, calling attention to factory accidents and methods for their prevention.

Miles M. Dawson gave an excellent resumé of the status of legislation in regard to employers' liability and workmen's compensation. The Hon. J. J. Feeley read a paper on strikes. Both this and the paper by Mr. Dawson are in print and obtainable for reference if desired.

The speakers at the banquet were W. Morgan Shuster, on the coming of peace with the increase of financial relations between nations; Franklin Mac Veagh, Secretary of the Treasury, on the tariff problem, and Dr. Arthur A. Hamerschlag, director of the Carnegie Technical Schools, on the problems of industrial education.

The officers for the ensuing year are: President, Henry D. Sharpe; vice-presidents, W. A. Layman and L. H. Kittredge; treasurer, Howard P. Eells; and commissioner, Robert Wuest.

Insurance Engineering considers that the automatic sprinkler is the greatest single factor of conservation in the industrial world of today. There are certain classes of manufactories that could not endure without the protection that this device affords, and this protection should be compelled by law to be installed in all buildings of combustible and otherwise unsafe construction and arrangement where people congregate either by compulsion or of their own volition.

The Double-spindle Flat Turret Lathe

By E. A. Suverkrop

A new double-spindle manufacturing lathe which can be used with either one or both spindles. When both spindles are used with a double equipment of tools the time to produce a given piece equals half of the sum of the time for all operations.

The halftones show a new double-spindle flat-turret lathe built by the Jones & Lamson Machine Co., Springfield, Vt., in use in the shops of the Brown-Lipe-Chapin Co., Syracuse, N. Y.

This machine is designed primarily for chuck work and can be used either as a single or a double-spindle machine. When but one spindle is used it will carry a chuck 17 in. in diameter, and when both spindles are used each spindle will swing a 9-in. chuck.

For small lots of work the single spindle is used, necessitating only a single equipment of tools. Where the lots are large, such as the bevel gear blanks shown, which are turned out in thousands, both spindles are used together, with a double equipment of tools.

Two similar cuts are carried at the same time; thus the total time is the sum of all operations divided by two. The extra spindle, or that shown to the left, is in the position usually occupied by the spindle-drive shaft on the 3-in. Jones & Lamson flat-turret lathe.

The top of the turret is square. Each edge may in turn be presented to the work and equipped with two sets of tools, the front set for the front spindle and the rear set for the rear spindle.

For the work shown only two opposite edges of the turret are used. The equipment for this work consists of a set of roughing and finishing tools for the face of the bevel pinion and a set of roughing and finishing tools for the back of the pinion. The forged pinion blanks go to the double-spindle flat turret lathe just as they come from the forge except for the square broached hole in the center. The method of holding and driving this work in the lathe is new, rapid and accurate.

At *A*, Fig. 1, is shown one of the mandrels on which the pinion blanks are mounted. These mandrels, as shown in Fig. 3, are of steel, hardened and ground all over. In the center is a square *L* which is a snug fit for the square hole in the blank. On each end of the square, the large cylindrical part *M* is provided with two milled slots *N*, which engage floating driving pawls in the spindle nose.

The smaller cylindrical part *O* at each end is ground a snug fit for a hardened and ground steel bushing in the spindle and 0.001 inch smaller than the bushings in the center of the tool heads. In other words, each end of the mandrel is provided with duplicate driving portions and duplicate pilots fitting hardened and ground bushings in the spindles and tool heads, so that the mandrels can be driven with either end out.

The operation is as follows: The operator presses a pinion blank on one of the mandrels and places it in the front spindle with the back of the pinion in position to be operated on as shown in Fig. 1. The turret is then brought up and the back of the gear is rough faced, the turret withdrawn, indexed and the back finished. The mandrel with the work still on it is then taken out by hand, turned end for end and put into the back spindle.

Another rough blank and mandrel are then put in the front spindle and the turret indexed again and brought forward. On this forward advance of the turret

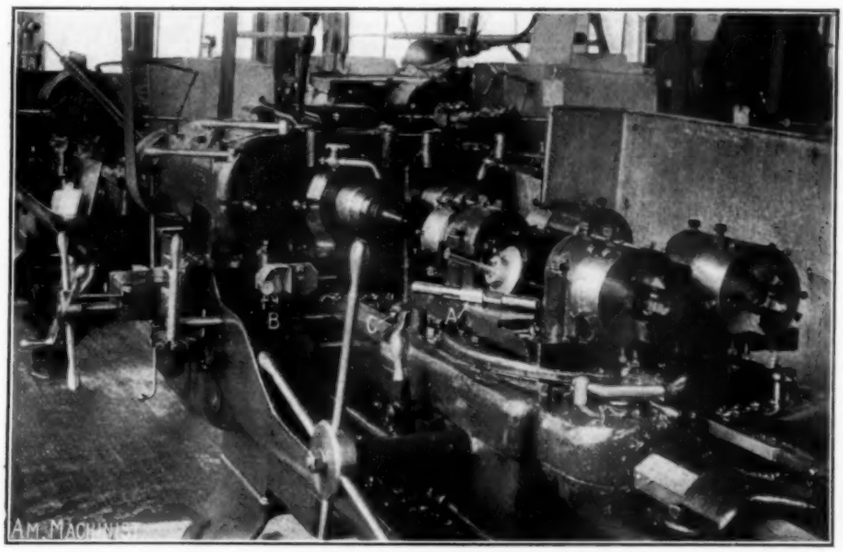


FIG. 1. JONES & LAMSON DOUBLE-SPINDLE FLAT-TURRET LATHE

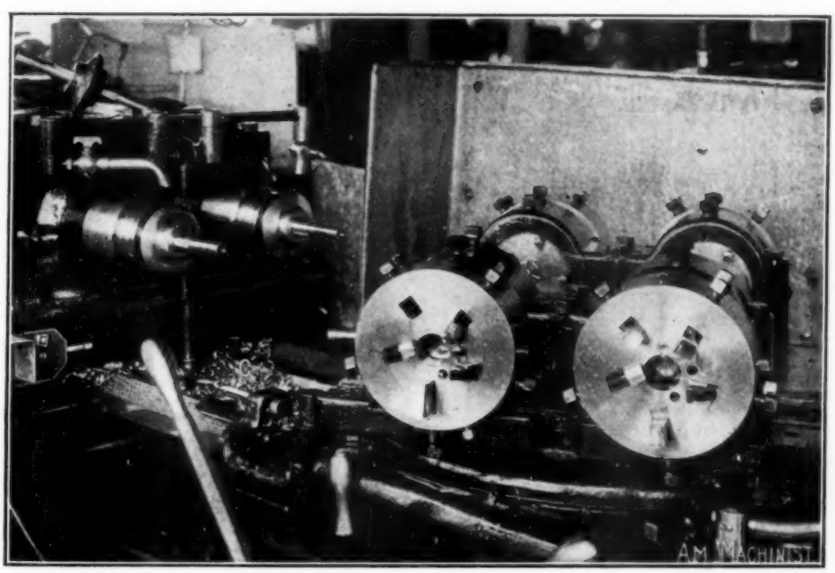


FIG. 2. GEAR BLANKS AND TOOL ARRANGEMENT

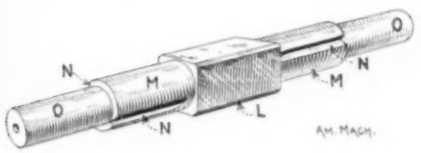


FIG. 3. THE MANDREL

the back of the blank in the front spindle and the face of the blank in the rear spindle are roughed. At the next indexing the back of the blank in the front spindle and the face of the blank in the rear spindle are finished; this, of course, completes the blank in the rear spindle. The conditions of the two blanks at this stage is shown in Fig. 2. The same motions are repeated and a complete blank is finished every two indexings of the turret.

Bed stops are provided but owing to the extremely accurate overall limits the Ames indicator shown at *B*, Fig. 1, was installed. A stop-pin *C*, Figs. 1 and 2, mounted on the turret slide comes in contact with the multiplying lever of the indicator and the operator can see at a glance when the cut has reached the correct depth.

On these gears the limits for length are +0 and —0.002 in. The gears machined were about 4⅛ in. in diameter and the production averaged 150 per 10 hours, but 198 have been done in this time.

Where Heat Closed a Hole

By A. L. George

The company I work for has seven log haulers at work in the woods, and on them are some steel sprocket wheels, about 3 ft. in diameter. These are put on strong enough to stand the hardest of use. They often come back with the shaft twisted off. So we shrink them on and key them too, or in other words, shrink them onto a key.

To do this we have always built a wood fire outdoors and heated them to a red heat. It always worked fine. Just now when it is 32 deg. below zero it is not pleasant to work out, so we tried heating them in the blacksmith's forge. I heated to a nice red and the fit I know was made right, but when we tried to put it on it would not go. I calipered and found that the hole was smaller than before heating. This was the first time in my life that I ever knew heat to make a hole small.

After reasoning the matter out I could plainly see that this method of heating in the forge only heated the hub while the rim of the wheel was cold, and thus prevented the hub from expanding. So I again built the fire out doors and heated the whole wheel, but the hole in the hub refused to expand. I cooled it off and went at it with my calipers. I found the hole was small and oblong and full of bunches; I therefore put it into the lathe and bored out at least $\frac{1}{32}$ in. to get the hole back to its former size.

I thought of an iron band I shrank onto the hub of a coupling 29 years ago, and reasoned that if that would squeeze up the hole in a piece of cast iron, why would not the rim of this steel sprocket wheel when cold, squeeze up the hole in the hub when it was hot?

After heating the hub of this sprocket wheel without heating the rim the hole was at least $\frac{1}{32}$ smaller than before heating. You can overcome this any way you like, but if you ever have occasion to shrink on anything of this nature it will be safest to heat the whole wheel.

Equalizing Vise Jaws

By E. A. Ermold

The vise jaws shown were designed to hold a number of the pieces illustrated in Fig. 1, while being slotted in the miller. They were made in the automatic screw machine from screw stock and it was necessary to hold the piece at its largest diameter. As the work would vary from 0.003 to 0.004 inch it was further necessary to embody in the design some pressure-equalizing device to hold a number of pieces to be operated on at one time.

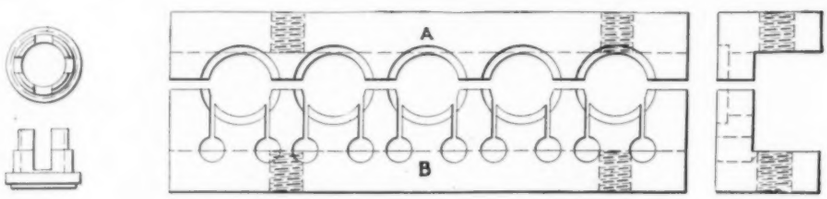


Fig. 1 Fig. 2

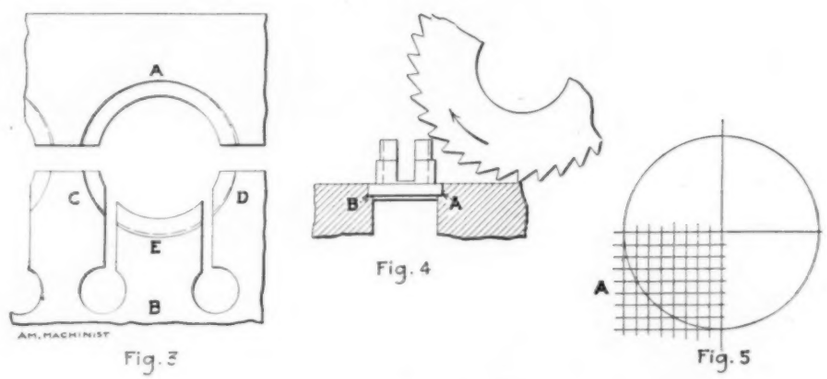


Fig. 3 Fig. 4 Fig. 5

Equalizing Miller Vise Jaws

It will be noticed by referring to Fig. 1, that there are two slots at right angles to each other. As any indexing device would be expensive to make and as the work did not demand a high degree of accuracy, it was decided to use vise jaws and after milling the first slot turn the pieces one-fourth turn and place a piece of drill rod in the slots to line them up for the second slotting.

Principles Underlying the Design

The construction can be easily understood by reference to Figs. 2 and 3. There are, however, several principles involved in the process of designing, the details of which should appeal to those of an analytical turn of mind.

Referring to Fig. 4, in which is shown the actual working conditions, it is readily seen that the milling cutter will tend to lift the work at *A* and turn it about a point at *B*, therefore the best place to hold the work is at the greatest distance from *B*, which is at *A*.

The next step is suggested by a slight knowledge of analytics, and for reference the circle at Fig. 5 has been drawn, and ordinates and abscissas in one quadrant laid off. By carefully examining the points of intersection with the circle it will be noticed that at the 45-deg. line any change in the abscissa produces a corresponding change in the ordinate and *vice versa*. But if a point on the circle at *A* in the same figure is taken it will be noticed that a very slight change in the abscissa produces a very considerable change in the ordinate. This is why the portions *C* and *D*, Fig. 3, are taken as the other gripping points, as a very slight lateral movement of *C* and *D* permits the jaw *B* to approach jaw *A* a considerable distance. The jaw *B* must be relieved at *E* as shown by the dotted lines, else the purpose of the scheme will be defeated. Jaw *A* is also relieved at the dotted line to permit a slight rolling of the work as it adjusts itself to the final position of *C* and *D*.

The jaws were constructed tentatively with the object of securing correct data in order to prove the efficacy of the design. The circular seats were therefore first bored in the jaws, and before slotting and relieving were placed in the vise and the work clamped, when it was found that they would only grip the largest pieces. After slotting and relieving their action was all that could be desired and in actual use not one in 5000 pieces pulled out under the cutting strain.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.
Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1911, 1,358,200 copies. For March, 1912 (American weekly, American monthly, English weekly and German weekly), total, 91,250.

Of this issue, 21,500.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 169

American Machinist

Are Machine Builders Unprogressive?

One of the interesting points brought out at the recent meeting of the American Society of Mechanical Engineers regarding the adoption of the U. S. standard thread indicates that the builders of machines are less progressive than the bolt and nut makers.

Figures given by Charles P. Russell, of Wiley & Russell, the result of correspondence with various tap makers, show that 99 per cent. of the tapper taps sold had U. S. standard thread. As these are used almost exclusively in the tapping of nuts, it shows that the old V-thread has practically been eliminated, so far as bolts and nuts are concerned.

In the case of hand taps, however, an entirely different condition of affairs exists, as nearly half of the hand taps are still made with the V form of thread. As these are the taps used in machine building for tapping holes in parts of the machines themselves, it would indicate that the machine builders have not been as progressive in this respect as they are usually given credit for.

These holes are usually tapped for tap screws, or tap bolts or studs, and this indicates that a demand for these screws and studs cut with the U. S. standard thread would soon bring their makers into line with the bolt makers and greatly increase the interchangeability by the adoption of the U. S. standard form of thread for all purposes of this kind. As this seems to be entirely in the hands of the machine builders we believe the elimination of the V-thread may be looked for as soon as the builders realize to what extent they are standing in the way of standardization.

Compare With the Best

The apparent value of any commodity, the efficiency, if methods of work or management are being considered, depends entirely on the yardstick we use in measuring it. Its real value may be entirely different when we find a yardstick of higher grade.

We can all recall instances where shop methods have been greatly improved and outputs largely increased by introducing devices which had been common for years in other shops. And we also remember, usually with chagrin, instances where we have carefully guarded improved devices, only to find that our neighbor had used them before we thought of them.

For this reason it is hardly safe to call attention too loudly to any method or system, no matter what savings we have made, until we know that the best results at least average up with those obtained in other shops. For it is just possible that we have been far below the average before the changes were made.

Any bright shop manager, whether he has ever formulated a system or not, can show real economies in the average shop and make astounding savings in shops which are particularly bad. And it is a safe prediction that the phenomenal savings which are given as shining examples of any system, were made in this kind of a shop.

On the other hand, it is equally safe to predict that there are few shops, even those which have been systematized to the limit, in which a good man cannot make improvements and savings. For behind all systems must be men with ideas, men who can study the good and bad points of any device and decide which have the most weight in that particular case.

For these reasons, it is well to avoid jumping at conclusions when reports of startling savings are made, as often happens. Not that they may not be perfectly accurate in every particular, but because the improved condition may be no better than that of your own shop. A little improvement will show a much higher percentage of saving in a poor shop than in a good one.

The same reasoning should also be used in comparing new and old devices. An improvement over the old may not be worth considering, because the old is the poorest of its type and the improvement may be far behind later developments.

Whatever we are considering should be compared with the best we know of, and not with the worst. By so doing we shall avoid many disappointments and incidentally save considerable money from time to time.

A Depreciation Fund

In slack times prepare for the rush to come, is considered as true a maxim as, "In times of peace prepare for war."

One part of the machine shop's preparation for rushing times is the buying and installing of new equipment. But this must be paid for, and funds are not always plentiful when business is not brisk.

The new equipment—particularly machines and tools—should be bought each year with the funds charged off for depreciation. Recognizing this, it has been suggested that the amount charged off as machine and tool depreciation should go into a separate fund held apart from the working capital, and used only for the definite purpose of buying new equipment. It is pointed out that should this course be followed, a machine shop would always have money for new machines and tools.

The objection can be raised that the earning power of the money used in the regular business may be four or five times the interest return from short-term loans—the only use that could be made of such a depreciation fund, if it was to be always ready for use. Thus, the earning power of the money in such a fund would not be very great.

On the other hand, it is expected that new equipment should be purchased each year in proportion to the amount written off for depreciation, and as the new machines would be of modern construction, the efficiency of the producing facilities would constantly improve. This improvement might more than offset any loss in the earning power of the money actually involved. Instead of using an engine lathe for 20 years, it might thus be replaced in eight or ten, to the immediate advantage of the producing power of the shop.

In any event, the constant improving of machines and tools is the only course to follow. If a definite depreciation fund is established, the fact that new equipment

should be bought during a given year to at least a minimum amount, will be forcibly brought home to those in charge.

Making Standard Jig Bushings

There are many shops both large and small which use drilling jigs quite extensively and yet are not equipped with the most modern machinery for producing these hardened-steel bushings for guiding the drill. In view of this, and as a result of several inquiries along this line, it seems as though it might be possible to make and market hardened-steel bushings of standard sizes so that they could be bought and used in connection with jigs made to suit special work.

There has been considerable work done of late years in standardizing the sizes of such bushings, a large variety of these being shown in the "American Machinist Handbook" and in the articles by L. L. Haas in the columns of the AMERICAN MACHINIST during the past year.

Knowing that standard bushings of this kind could be obtained, it would be an easy matter to design the jigs in such a way as to accommodate them and there can hardly be a doubt as to the economy of this method, especially in shops not equipped with modern grinders.

Following the trend of modern industry for the subdivision of labor into smaller and smaller fields this seems as though it might be successfully carried out, just as the makers of ball handles for machine tools have developed a special business supplying a part which was formerly made in each shop for their own machine.

While there are many details to be worked out in the inauguration of any new business it seems perfectly reasonable that standard steel bushings should be made and it should prove of value to tool designers in many small shops.

NEW PUBLICATIONS

EFFICIENCY AS A BASIS FOR OPERATION AND WAGES. By Harrington Emerson. 254 pages, 5x7½ in. Published by the Engineering Magazine, New York. Third Edition, Revised and Enlarged. Price, $2.

Since the first edition of Mr. Emerson's book in 1909 much water has gone over the weir. Industrial management, thanks to an enterprising press, has become everybody's business, and in the popular mind everybody knows more about it than the unfortunates who have the experience and the responsibility for the management of large undertakings. In particular we are all convinced that railroad managers are a body of peculiar shiftlessness and incompetence; that is to say, all of us not connected with railroads. How far the writings of the new school of efficiency promoters are responsible for this gratuitous criticism it is difficult to say.

The great discovery of Mr. Emerson and those who think with him is that all human endeavor is accompanied by waste. Theoretically these wastes can be eliminated; they can be planned out of existence. In practice, however, this sometimes proves a more difficult task than it appears. It is not easy to key human nature up to that pitch of efficiency —and keep it there.

It is quite certain that at this time improvements on the way of doing things are possible. That is the law of progress, and progress is always with us, just as surely as it may be said that some of us will fail to take advantage of the facilities for doing our work that progress brings. But to assert that there is something so radically wrong in the conduct of industrial operations at the present day that a great leap forward may be taken, here and now, is a much more doubtful proposition.

It is claimed that Mr. Emerson's development of the efficiency system is "large enough to form the basis of a philosophy, and hopeful enough to have won the designation of a 'gospel.'" It may be so, but just what this philosophy is and just what this gospel preaches are things difficult to discover—or at any rate, to express in practical terms.

Let us, however, be just to Mr. Emerson. Though it is hard to believe that he has discovered any important guiding principle of a novel character, yet it is not too much to say that "Efficiency" is a great and important book. He has the true touch of the prophet. He makes us think. He destroys our self-complacency, and puts the fear of progress into our hearts. We do not yawn over his pages. On the contrary, as we read, we cannot fail to be stirred with the desire to get up and do something in the way of setting our own house in order. Very few of the new school of industrial thought have that gift.

The present edition is not merely a reprint, but has been revised throughout and amplified in several sections, notably Chapters IV, V, VI and VII. These changes have been so considerable that the old plates were abandoned and the whole book reset.

Considerable changes appear to have been introduced, as regards practical details, since the first issue of this book. The subdivision of costs into materials, direct labor, and overhead, has been altered to materials, all personal services or payroll, and equipment charges, the last stated to consist, generally, of four items, "taxes, insurance, depreciation, and interest on investment."

Direct machine rates make their appearance for the first time in connection with this system. The doubtful expedient of a burden charge on materials is also introduced. A formidable algebraic formula consisting of 18 elements is also given, purporting to be a "complete cost and efficiency formula." In a subject of this kind such formulas must be regarded as wholly unnecessary and likely to darken counsel.

MEASUREMENT OF HIGH TEMPERATURES. By Burgess & Le Chatelier. 510 9x5½-in. pages; 178 illustrations in the text; a bibliography; 10 tables; indexed; third edition. John Wiley & Sons, New York City. Price, $4, net.

This third edition of a well known work has been rewritten and enlarged so that it is now no longer a translation of the original French work, but rather a new book.

During the past few years the subject of automatic temperature recording has received a great deal of attention, which resulted in the development of many new instruments. So far as is practical in this book attention is paid to the principles underlying these instruments rather than to particular types.

Throughout, three classes of readers have been kept in mind, the student who is interested in the historical aspect and fundamental principles, the engineer who desires to adapt some method or instrument to his particular need, and the investigator who desires to know the adaptability of accurate methods of measurement to some problem that is before him. The extensive bibliography is one of the valuable features of this revised work.

PERSONALS

Willard E. Lape, mechanical engineer, has been appointed general manager of the Syracuse Heater Co., Syracuse, N. Y.

J. W. Carrel, general sales manager of the Lodge & Shipley Machine Tool Co., Cincinnati, O., has returned from an extended European trip.

Carl Ehrmann, who has conducted a mechanical engineer's office in New York City, has become chief draftsman of the Didier-March Co., South Bethlehem, Penn.

W. T. James has resigned his position with Wheelock, Lovejoy, & Co., in order to establish the Newark Metal Treating Co., Newark, N. J., of which he is to be president.

E. Hawkinson for the last three years foreman in the tool-making department of the Canadian General Electric Co., has resigned to take up the position of tool designer for the Russell Motor Car Co., W. Toronto, Can.

Willian Bishop, for the last six years manager of the machinery and equipment department of the Cincinnati Iron and Steel Co., Cincinnati, O., is now associated with Manning, Maxwell & Moore looking after their crane interests in Chicago.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

Bicknell-Thomas Clutch

In Fig. 1 are shown single and double clutches of a type recently developed by the Bicknell-Thomas Co., Greenfield, Mass.

This type of clutch is self-contained and self-adjusting for wear and varying load conditions. It can be mounted on the line shaft and belted direct to the machine, thus avoiding the use of countershafts.

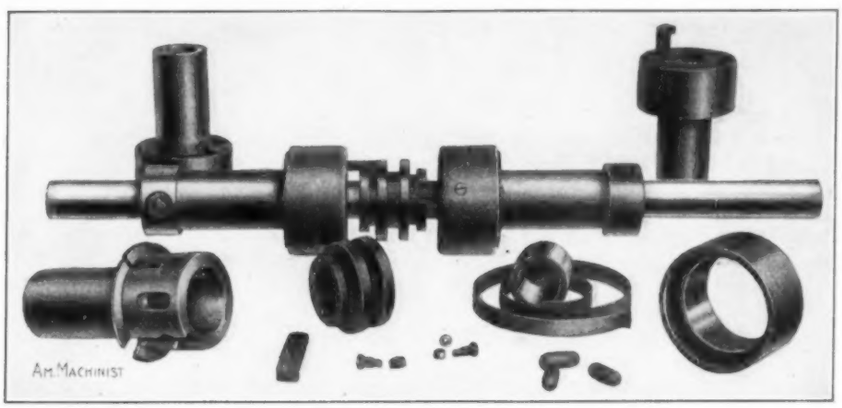


FIG. 1. SINGLE AND DOUBLE CLUTCHES

FIG. 2. SECTIONAL VIEW OF CLUTCH

The working action of the clutch can be gathered from the sectional view shown in Fig. 2.

Inside the body *A* of the clutch, which is free to rotate upon the shaft, is a hardened steel bushing *B*, which is keyed to the shaft. Loosely mounted on the end of the clutch body is a hardened-steel cam ring *C*, fitting into slots in the body *A*, and interposed between the bushing *B* and the cam ring *C* are three hardened steel rolls *D*.

One end of the flat coil spring *E* is fastened to the body *A*, and the other end to the cam ring *C*, which is held onto the body *A* by means of the screw and roll *F*. On the inner periphery of the cam ring *C* and directly over the rolls *D*, are cam surfaces, as shown at *H*.

The clutch as shown is in working position, which is accomplished as follows: Assuming the shaft to be the driving member and rotating in the direction shown by the arrow, by pressing the releasing slide *G* into the clutch, the coil spring *E* causes the cam ring *C* to slightly rotate upon the clutch body, causing the rolls *D* to move inwardly and wedge between the driving bushing *B* and the cam ring *C*. Then the rolling action between the driving bushing *B* and the rolls *D* causes the latter to grip tightly on the cam surface on the inner periphery of the cam ring *C*, thus causing the clutch and shaft to rotate as a single unit.

Horizontal Cylinder Boring Machine

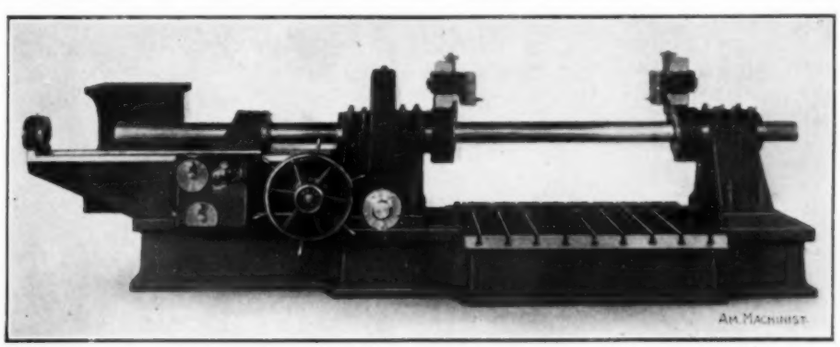
The halftone shows a recent pattern of horizontal cylinder boring machine, built by the Barrett Machine Tool Co., Meadville, Penn., designed for boring and facing simultaneously, steam, gas, gasoline, pump and locomotive cylinders.

The machine is mounted upon a heavy bed, 15 ft. 1 in. long; the widened portion is 51 in. wide by 68 in. long, 18 in. high, with nine cross T-slots and two longitudinal T-slots. The pedestals are 24 in. from top of the bed to the center of the boring bar and the tail pedestal is adjustable on the bed from zero to 60 in.

The boring bar is 6 in. diameter, and has a continuous feed travel in either direction of 60 in. It will bore out a cylinder of this length with one setting. The end is fitted with a No. 6 Morse taper hole, with draw and drift slots, so that smaller bars can be used when required. In this case it is necessary to use a sleeve placed in the tail pedestal bearing for supporting the outer end of the smaller bar.

The machine is equipped with a quick-change feed box mechanism having ten different feeds as follows: $\frac{1}{32}$, $\frac{3}{64}$, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$, $\frac{5}{32}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, and $\frac{3}{8}$ in. per revolution of the boring bar which are almost instantaneously available. The power is transmitted by the Hindley type of worm and wormwheel.

There are two heavy facing arms mounted on the end of the sleeves. They



HORIZONTAL CYLINDER BORING MACHINE

are driven by friction and may be started and stopped at will by simply tightening or releasing a collar bolt. When not in use they hang on the end of the sleeves and do not interfere with the rotation of the boring bar or the longitudinal travel. They are provided with a sliding block which travels at right angles to the boring bar. This block is fed in and out with a star feed, and mounted upon this is a secondary block which carries the tool for facing off or turning the outside diameter of the cylinder flanges.

The tool in the latter sliding block is made of 1 in. square stock and when placed in the lower slot can be fed down within 1 in. of the boring bar. The tool can readily be removed without changing the position of block as it is withdrawn from the back end. The cone pulley has five steps, 13, 16, 19, 22 and 25 in. in diameter, with a corresponding cone on the countershaft. The countershaft has two friction pulleys 16x5 in. for double speed, giving ten speeds to the boring bar.

The halftone shows the machine arranged with a bracket bolted to the side of the extended frame for supporting a variable-speed motor for driving. The connection in this case is made from the motor to the driving shaft by an endless belt.

"Magnalamp" for Machine Tool Lighting

The type of electric lamp shown was designed to facilitate proper lighting on machine tools and in work where the chief importance of the light is in having it at certain individual spots.

It is a portable electric lamp using the

FIG. 1. THE "MAGNALAMP"

ordinary incandescent bulb but inherently possessing magnetic power developed in an electro-magnet. When placed on any mass of iron or steel, smooth, rough, or otherwise, it sticks and holds itself in the position placed with a pull of many pounds. It hangs vertically from a surface above or extends sidewise just as rigidly as to a surface on top of which it may be placed. Its position can, of course, instantly be changed, and the grip is unaffected by vibration or temperature.

The complete "magnalamp," as shown in Fig. 1, with its magnet surmounted by

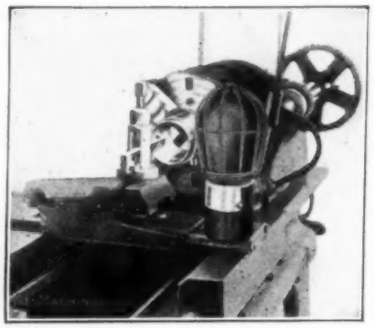


FIG. 2. USED ON THE LATHE

the lamp, connection receptacles and suitable mechanism, forms a cylinder measuring less than 3 in. in height. It is only 2½ in. in diameter, and weighs less than 2 lb.

The bulb is protected by an electrically welded guard, extending either longitudinally from the top end of the cylinder or radially from the side. A reflector, detachably fitted to the inside of the guard is also provided.

The same current supplies the lamp and the magnet, and is controlled by a quick-acting switch operated by means of a knurled disk forming the central pole piece of the magnet.

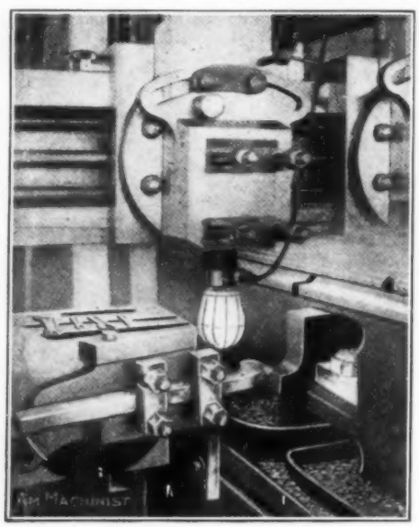


FIG. 3. USED ON THE PLANER

Gripping this pole piece with the thumb and forefinger, on its knurled edge, and turning it clockwise, turns the switch completely on or off with each snap. This switch cannot be operated when the magnet is in use. Grasping the lamp in the hand, after the current has been turned on and the lamp lighted, and pressing the little push-button extending radially from the side of the switch and receptacle casing above the magnet, deënergizes the magnet, so that the lamp may be placed, removed or changed in position. Releasing this button instantly brings the magnet into service again.

After the light has once been turned on by the switch it remains on irrespective of whether the magnet is cut out and consequently it is never necessary to manipulate the lamp without light.

In Figs. 2 and 3 two typical machine-tool applications of the lamp are shown on the planer and lathe.

This type of lamp is a recent development of the Sachs Laboratories, Inc., Hartford, Conn.

Oil Filter for Machine Tools

An individual oil filter for machine tools has been developed by Wm. W. Nugent & Co., Chicago, Ill.

It is of the type manufactured by this firm for a number of years for power-plant use. Fig. 1 shows a filter attached to a pipe-threading machine.

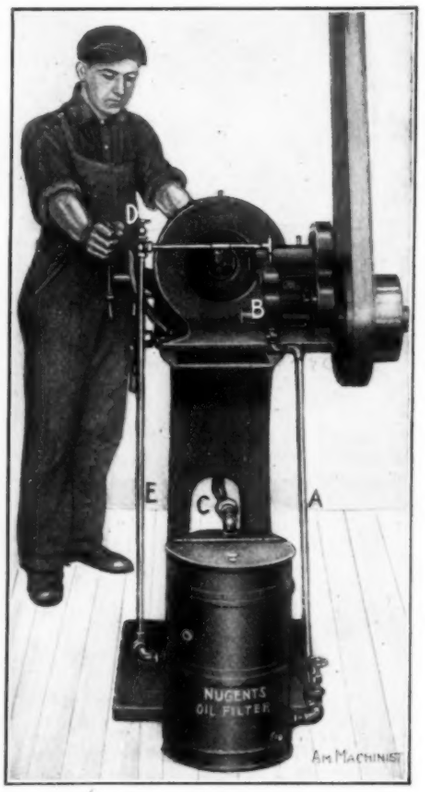


FIG. 1. OIL FILTER APPLIED TO PIPE THREADER

Fig. 2 shows another size open for inspection.

In consists of a cylindrical sheet-steel tank having a settling chamber at the top for the dirty oil as it drains back from

the machine, a nest of three filtering bags beneath this upper chamber, and a storage space for filtered oil at the bottom. The oil feeds through by gravity.

The necessary pipe connections are the suction coming from the bottom of the tank, *A* of Fig. 1, the overflow from the pump also leading to the bottom of the tank, *E* of Fig. 1, and the drain or return from the machine, *C*, leading to the upper chamber. In this same illustration *B* is the pump and *D* the overflow valve.

The filter can be placed in any con-

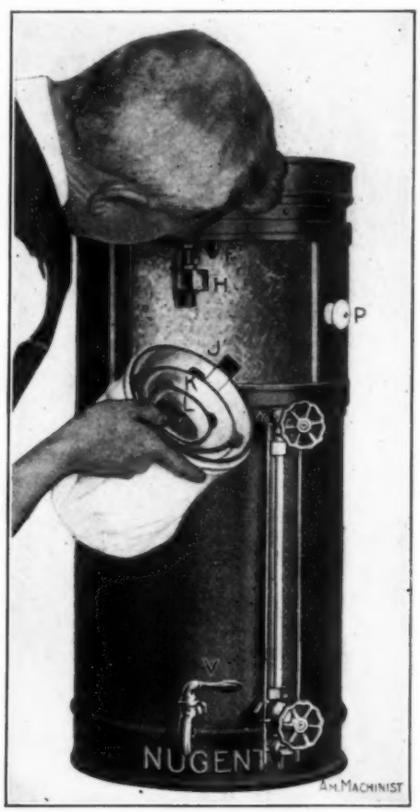


FIG. 2. OPEN VIEW OF FILTER

venient place near the machine it is to serve.

The filtering medium consists of three bags arranged as shown in Fig. 2. The inner one *L* is of a rather coarse-mesh material and catches the larger particles in the dirty oil. The other bags *J* and *K* are of finer material with a canton-flannel finish on the inside. Each bag is attached to a metal ring; these rings fit together as shown.

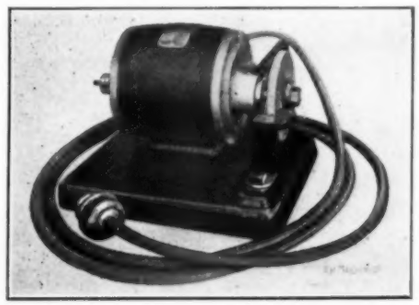
The bags are easily removed through the opening in the side of the tank closed by a sliding door, *P* of Fig. 2. This is only necessary when they become clogged. They are readily cleaned by washing in kerosene without removing from the rings.

This filter is made in a number of sizes. The size of Fig 1 is the smallest and does not have the sight glass and chain cock *V* of the size of Fig. 2. It can be adapted to any machine using cutting oil.

Bench and Tool Post Grinder

The grinder shown herewith is mounted on a hollow iron base for bench work.

By removing two screws on the under side of the base, the grinder and tool-post bar can be removed and used on the lathe or shaper for grinding centers and similar light work. Means are provided for taking up end play and wear by a nut at the rear end of the shaft, and a



BENCH AND TOOL-POST GRINDER

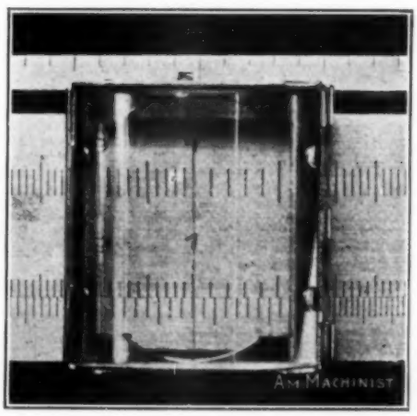
split tapered bronze bushing at the wheel end of the shaft. The shaft is off center, allowing the use of wheels of small diameter, and oil cups are so placed that the bearings are properly lubricated in any normal position of the tool. The motor is air cooled by force circulation, and has radial, self-feeding carbon brushes, requiring no adjustment.

This tool is made by the American Electric Tool Co., West Newton, Mass.

Magnifier for Slide Rule

This handy little device will be appreciated by those making extensive use of the slide rule.

It consists of a sliding aluminum frame with a convex cylindrical magnifying glass fitted over the regular flat glass. The magnifier greatly facilitates the use



MAGNIFIER FOR SLIDE RULE

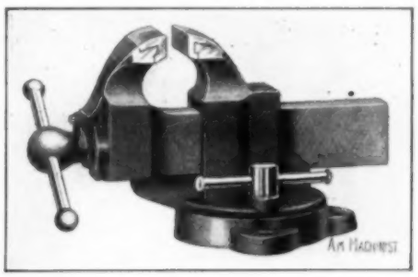
of the rule and eliminates the trying effect on the eyes common to the use of the rule without this device, besides making for greater accuracy.

It is made by the Keuffel & Esser Co., New York City.

Machinist's Vise

The steel faces used in the vise shown herewith are milled and fitted to the jaws, and are renewable.

The vise has a swiveling base, operative at any point, and adjustable. The



MACHINIST'S VISE

latter feature enables the vise to be converted for the use of a left-hand workman.

It is made in a variety of sizes by the Charles Parker Co., Meriden, Conn.

Small Shop Apprenticeships

BY E. W. TATE

As a great deal has been written concerning the apprenticed machinist in the large shop, and nothing of the small shop, I venture to describe the workings of an apprenticeship in the small shop. In the shop in which I am employed, we have nearly 200 men, of whom about 15 per cent. are apprentices. Application for an apprenticeship is made on a form in which is stated the age, education, previous occupation and references. As there is always a number of applications on file, they are considered in order; occasionally, however, one is taken out of order.

When an applicant is accepted he commences on a three-month period of probation. This trial period was set, not only for the benefit of the company, but for the apprentice also. For what would be worse for a young man than to bind himself to serve an apprenticeship, and after a short time discover that he had erred in judgment and wished to enter some other profession? At the end of three months (if, during that period there is mutual satisfaction) the apprentice is required to furnish a bond that he will serve the remainder of the apprenticeship, and be governed by the rules and regulations of the shop.

The apprentice is always considered before the journeyman. Home study is encouraged and each apprentice is furnished with a free subscription for one of two of the leading trade papers.

That the apprentices receive a thorough training is proved by the fact that the present superintendent, assistant superintendent and all of the shop department foremen served their apprenticeship in this shop.

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

Metal Working

NEW ENGLAND

The St. Germain Marine Co., Greenville, Maine, has been incorporated and will erect a factory for the manufacture of boats and engines. Capital, $10,000. W. H. St. Germain is president, and Ross St. Germain, treasurer.

Charles L. Sanderson, Clinton, Mass., will erect a large garage and machine repair shop.

The Gardner General Foundry Co., Gardner, Mass., has let the contract for an addition to its plant.

The Cape Cod Garage, Hyannis, Mass., was destroyed by fire, Apr. 3. Loss, $25,000.

Geo. P. B. Alderman & Bro., architects, Holyoke, Mass., will have plans completed soon for a brick garage to be erected in Palmer, Mass., for W. E. Woodmansee. It will be one story high, 40x75 ft.

The General Electric Co. will spend $500,000 for enlarging its plant at Pittsfield, Mass.

J. S. Butler, Salem, Mass., will build a concrete garage on Derby St., with a floor space of 5000 ft. Estimated cost, $8000.

The Hamilton Woolen Co., Southbridge, Mass., will erect a large machine and carpenter shop.

The Weir Stove Co., Taunton, Mass., is having plans prepared for the construction of a new three-story brick factory.

The Sewer Department of the city of Worcester, Mass., will erect a new brick blacksmith shop, 36x26 ft., at 44 East Worcester St., 1½ stories high.

Plans are being figured for another large addition to the plant of the E. H. H. Smith Silver Co., Bridgeport, Conn., in the East End. The building will be of brick, mill construction. The Fletcher Engineering Co. is the architect.

The Gaynor & Mitchell Manufacturing Co., Bridgeport, Conn., will remove its brass plant to Stralford Ave.

W. P. Crabtree, architect, New Britain, Conn., is preparing plans for a new garage to be erected in the rear of Main St. for W. W. Hanna and Elizabeth J. Anderson. It will be brick, about 83x157 ft., one story high and basement.

Frank H. Alford, New Britain, Conn., will erect a commercial garage on Main St.

The Waterville Corporation, manufacturer of brass goods, has secured a permite for the superstructure of its new plant at Waterville, Conn.

MIDDLE ATLANTIC STATES

The Strong Steel Foundry Co. is having plans prepared for its new foundry plant at Hertel Ave. and the Erie R.R., Buffalo, N. Y. Steel frame buildings with corrugated iron sheathing, will be erected. O. H. P. Champlain is president.

The Buffalo Gasoline Motor Co., Buffalo, N. Y., will erect a two-story brick addition, 120x130 ft., on Audubon Ave. Equipment of machinery will be required.

John J. Murphy contemplates remodeling the Lord Block on Water St., Corning, N. Y., which he recently purchased, and using it for an automobile garage.

The second floor of the six-story building, at 17 John St., New York, occupied by John Dempsey, nickel plater, and the American Novelty Co., was damaged by fire, Apr. 5. Loss, $15,000.

The garage of Hannan & Henry, Ogdensburg, N. Y., was destroyed by fire, Apr. 5. Loss, $200,000.

C. E. Hartson, Syracuse, N. Y., plans to begin at once the construction of a two-story garage at 190-192 Monroe Ave.

M. Lewis, Utica, N. Y., has obtained a permit for the erection of a two-story garage at 44 Seneca St. Estimated cost, $8000.

Fire damaged the building on Nepperhan St., Yonkers, N. Y., Apr. 7, occupied by the Yonkers Electric Plating Works and the Westchester Electric Equipment Co. The loss approximates $10,000.

It is reported that the Crocker-Wheeler Co., electrical manufacturer, Ampere, N. J., will construct a new seven-story building, at its plant.

R. C. Edwards, owner of the taxicab stand at Atlantic and North Carolina Aves., Atlantic City, N. J., intends to erect a two-story garage.

Fire destroyed the plant of the Philadelphia Wire & Steel Co., at Delaware Ave. and Pearl Sts., Camden, N. J., Apr. 4. Loss, about $160,000, covered by insurance.

Dr. Joseph Stack, Hoboken, N. J., is erecting a building at 214-216 Clinton St., to be used as a garage. The new building will be two stories high, 50x105 ft. Estimated cost, $20,000.

The Titan Steel Casting Co., Newark, N. J., will erect a steel foundry at Lister Ave. and Chapel St., one story, 150x250 ft., and will expend about $8000.

The Standard Metal Manufacturing Co., Newark, N. J., is receiving bids for a three-story addition, 45x110 ft., to its factory, at Chestnut, Malvern and Jefferson Sts. The estimated cost is $20,000.

T. E. Bilquist, architect, 341 Sixth Ave., Pittsburg, Penn., is preparing plans for the construction of an industrial shop for the Pennsylvania Training School at Morganza, Penn.

Rogers Bros., machinists, 1411-1413 Reedale St., Pittsburg, Penn., are erecting a new shop opposite their present location.

The American Steel Copper Appliance Co. of America, Pittsburg, Penn., has made arrangements for building an extensive plant at Trout Island, near Sharpsville, Penn., at a cost of $150,000. The company has a site of 300 acres.

The Duff Patents Co., Boquet St., Pittsburg, Penn., maker of water-sealed gas producers and steel-plate construction, is making improvements to its North Side plant, which was damaged by fire, Mar. 16.

Hewitt, Granger & Paist, architects, Bullit Building, Philadelphia, Penn., are preparing plans for the construction of a brick and reinforced-concrete garage on Locust St. for the Bellevue-Stratford Hotel. It will be four stories high, 102x150 ft.

Plans are being prepared by T. J. Litzleman for the combining of the four plants of the Williamsport Staple Co., Williamsport, Penn., manufacturer of hardware and harness specialties, now in different localities, and the erection of a combined plant in Williamsport. Four buildings, each four stories high, will be erected. Estimated cost is $150,000.

Bids will be received for steel cylinders and bars, babbitt metal, bolster truck springs, pipe wrenches, brass pipe, etc., at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until Apr. 27, under Circular No. 698.

Bids are asked by the Paymaster-General, U. S. N., Chief of the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., as follows: Until 10 a.m., Apr. 16, Schedule 4405, Class 141, for delivery at the navy yard, Puget Sound, Wash., one gas-producing apparatus, operated by a three-phase, 60-cycle, 220-volt industion motor, apparatus to have a guaranteed evaporative capacity of 40 gal., California distillate; until 10 a.m., Apr. 23, Schedule 4433, Class 71, for delivery at the navy yard, Washington, D. C., one Everett-McAdam continuous electric blue printer. Schedule 4436, Class 101, for delivery at the navy yard, Philadelphia, Penn., within 30 days after receipt of order, one automatic railway cutting-off saw, motor driven, with iron table, complete, with one 16-in. saw, and countershaft on machine arranged for direct-coupled motor. Until 10 a.m., Apr. 30, Schedule 4458, Class 111, for delivery at the navy yard, Norfolk, Va., one power gap shear, to have 15-in. depth of throat; gap to have a capacity to shear iron or soft steel ½ in. thick and full 72 wide at one stroke.

SOUTHERN STATES

The Norfolk Southern R.R. is having plans prepared for the construction of shops at West Munden, near South Norfolk, Va. The estimated cost is $500,000. S. R. Mathes, Newbern, S. C., is master mechanic.

The R. L. Barnes Safe & Lock Co., Richmond, Va., will rebuild its plant recently destroyed by fire at a loss of $60,000.

The Boyd Iron Works, Richmond, Va., will rebuild its plant recently destroyed by fire, at a loss of $30,000. Noted Feb. 15.

The Rutherfordton Roller Mills, Rutherfordton, N. C., were destroyed by fire, Mar. 27. Loss, $4000; insurance, $2500.

A roller mill owned by Perry & Johnson, Silkhope, N. C., was destroyed by fire, Mar. 24. Loss, $8000. Insurance, $4700.

The contract for the erection of a garage for the Buick Motor Co., Peachtree and Harris Sts., Atlanta, Ga., has been awarded. It will be four stories high and cost $30,000.

The Harrold Banking & Savings Co., 416 Second St., Macon, Ga., will receive bids about May 1, for the construction of a commercial garage. It will be two stories high, 53x150 ft., of mill construction. The estimated cost is $15,000. F. R. Happ, Fourth National Bank Building, is the architect.

The Tidewater Co., Birmingham, Ala., will erect a car-repair shop and buildings at Ensley, Ala.

Fire destroyed the garage of T. B. Herndon, Mansfield, La., on Mar. 31. Loss, $3000; insurance, $2000.

The Price-Evans Foundry Co., Chattanooga, Tenn., manufacturer of ornamental iron, is having plans prepared by Beardon & Dean, architects, Chattanooga, for a new brick foundry, 90x110 ft.

Lewis A. Dunkel, Fort Plains, N. Y., is planning to remove the plant of the Empire State Metal & Wheel Co. to Nashville, Tenn.

The Gray & Dudley Hardware Co., Nashville, Tenn., will erect an addition to its buildings, on Centennial Boulevard.

MIDDLE WEST

The Grabler Co., Cleveland, Ohio, maker of plumbers' supplies, will make additions to its present plant.

The National Bronze & Aluminum Co., 2539 East Seventy-ninth St., Cleveland, Ohio, will enlarge its foundry and buy some new equipment.

The Kilby Manufacturing Co., Cleveland, Ohio, maker of sugar-beet machinery, will make additions to power plant and machine-shop equipments.

The Adams-Bagnall Electric Co., Cleveland, Ohio, maker of electric lamps, will erect a new factory.

The Bombgardner Manufacturing Co., Cleveland, Ohio, maker of casket-lowering devices, has started to rebuild the plant which was damaged by fire, and will buy new gas engine and other equipment.

The Hydraulic Presed Steel Co., 3152 East Sixty-first St., Cleveland, Ohio, maker of pressed-steel automobile frames, will enlarge its plant and buy some new equipment.

The Lake Erie Iron Co., Cleveland, Ohio, nut and bolt maker, will build and equip an addition to its factory.

The Lunkenheimer Co., Cincinnati, Ohio, will erect a two-story garage in connection with its plant on Waverly Ave.

The Stacey Manufacturing Co., Cincinnati, Ohio, manufacturer of gas-storage tanks and structural specialties, is building a large addition to its plant and will need equipment.

Contracts will be awarded shortly by the Herschede Hall Clock Co., for a new one-story factory, 290x135 ft., at McMillan St. and Essex Place, Cincinnati, Ohio. S. S. Godley is architect.

Contracts have been let by the Lodge & Shipley Co., Cincinnati, Ohio, for two machine-shop additions, each two stories, 160x32 ft.

L. H. Weissleder, Cincinnati, Ohio, will build a factory at Boone & Manitou Sts., for the manufacture of dry-cleaning machinery.

The Cincinnati Pulley Machinery Co., Cincinnati, Ohio, has increased its capital and will buy new equipment for machine shop.

The Champion Safety Lock Co., Geneva, Ohio, manufacturer of locks, will make additions to its machine-shop equipment.

The Jewett Car Co., Newark, Ohio, is in the market for additional equipment.

The L. Beckman Co., Toledo, Ohio, maker of engineering instruments, will build a new factory.

S. M. Foster, of the German-American Bank, Fort Wayne, Ind., is having plans drawn for the construction of a garage, 60x150 ft., on Barr St.

The Cole Motor Car Co., Indianapolis, Ind., has ordered plans for the construction of the second wing to its $300,000 factory on Washington, Davidson and Market Sts. The estimated cost is $100,000. Bids will be received as soon as plans are completed. Herbert L. Bass, Knights of Pythias Building, is the architect.

The Crary Machine Works, Benton Harbor, Mich., has awarded the general contract for the one-story factory, 50x100 ft., at $25,000.

The Thompson Auto Co., 972 Woodward Ave., Detroit, Mich., is constructing a one-story brick garage at the rear of its present building.

The Interchangeable Fixtures Co., Front and Myrtle Sts., Detroit, Mich., is having plans prepared for a two-story factory, 60x100 ft., costing $30,000. J. S. Fisher is manager.

The Detroit Automobile Garage, Detroit, Mich., was destroyed by fire, with a loss of $35,000. A new garage will be erected and new equipment will be needed.

The Fisher Body Co., Detroit, Mich., manufacturer of automobile bodies, will erect a brick and steel factory at Oakland and Piquette Aves.

The Ruby Manufacturing Co., Jackson, Mich., manufacturer of portable steel houses, will soon erect a one-story factory.

The Sparks-Withington Co., Jackson, Mich., maker of automobile accessories, is erecting a one-story addition, 75x125 ft.

The Withington plant of the American Fork & Hoe Co., Jackson, Mich., will be enlarged this spring by a new building.

The Ann Arbor R.R. Co. will erect additions to its buildings at Owosso, Mich. Joseph Ramsey, Jr., is the president.

The American Well Works, Aurora, Ill., will erect a one-story addition to its machine shop, 64x170 ft. New equipment will be needed.

The Belvidere Screw & Machine Co., Belvidere, Ill., will double its capacity during the next few months.

The Ajax Forge Co., 503-09 Blue Island Ave., Chicago, Ill., has commenced a one-story brick addition to its plant.

The American Radiator Co., of Chicago, Ill., and Cleveland, Ohio, will erect a factory near Irondale, Ala., at the cost of $1,000,000.

The McDavid Automobile Co., which recently opened salesrooms at Hillsboro, Ill., will soon erect a repair shop.

The spike mill of the Illinois Steel Co., Joliet, Ill., was recently damaged by fire with a loss of about $10,000.

E. E. Evans, Mercedes, Ill., will build a machine shop, 50x120 ft.

The Leavitt Manufacturing Co., Urbana, Ill., will rebuild plant recently destroyed by fire. The contract for the addition will be soon let.

E. A. Havens, Peoria, Ill., has awarded the contract and will erect a two-story factory, 50x150 ft., for making patterns, Averyville, Ill.

Plans are being prepared for the erection of a new factory for the Warner Instrument Co., Beloit, Wis. It will be three stories, 100x100 ft., of reinforced concrete and brick.

The Janesville Machine Co., Janesville, Wis., have let the contract for the construction of a two-story steel fireproof plow shop, 143x143 ft.

The Racine File Co., Racine, Wis., has started work on its new brick fireproof factory.

E. J. Earling, 196 Queen Anne Pl., Milwaukee, Wis., will erect a garage at Wauwatosa, Wis.

WEST OF THE MISSISSIPPI

The Barton-Ford Motor Car Co., Cedar Rapids, Iowa, will construct a brick and concrete garage, 40x100 ft., at 616 Second Ave.

The Charles City Engine Co. will build a factory, at Charles City, Iowa.

The North Star Machinery Co., Crookston, Minn., will rebuild and enlarge its plant, which was damaged by fire last fall.

The Crookston Iron Works will enlarge its machine shop and will erect a new tool room and offices with concrete floors. J. C. Morrisey is the owner.

The McCord-Brady Co., Omaha, Neb., has awarded the contract for the construction of a garage at Twelfth and Leavenworth Sts.

The plant of T. F. Stroud & Co., manufacturers of implements, Twentieth St. and Ames Ave., Omaha, Neb., was destroyed by fire, Apr. 6, at a loss of $200,000.

The Kalispell Auto Co., Kalispell, Mont., is constructing a fireproof garage of brick and steel, 50x100.

The Busch-Sulzer Bros.-Diesel Engine Co., Broadway and Pestalozzi St., St. Louis, Mo., will erect a plant in St. Louis, to cost about $1,000,000. The contracts have been awarded.

The interior of the workshop of the Gearhart Auto Works, Travis St. and Rusk Ave., Houston, Tex., was destroyed by fire, Apr. 4.

The contract for the construction of the plant of the Industrial Cotton Oil Co., Houston, Tex., recently destroyed by fire, has been awarded. Four buildings will be erected, one 100x500 ft., and the rest 80x480 ft., one story high. J. L. Hudgins is general manager. Noted Apr. 4.

The San Antonio Wire & Nail Works, San Antonio, Tex., will construct a plant on North Cherry St., for the manufacture of iron and wire supplies.

The Thorndale Garage, Thorndale, Tex., was burned, Mar. 31, at a loss of $5000. Insurance, $3000. M. C. Sides is the owner.

D. Carson Fleming is interested in the construction of a $30,000 garage having a frontage of 75 ft., to be erected in Denver, Colo., this spring.

WESTERN STATES

The Peerless Fuller Self-Closing Faucet Co., Salt Lake City, Utah, which has been recently incorporated with a capital of $70,000, will build a factory.

William Heim, Fresno, Calif., is having plans prepared for a commercial garage and repair plant to be erected on North J St., Fresno.

The Union Tool Co., Los Angeles, Calif., has had plans prepared for the construction of two additional factories to the plant now being erected at the new industrial city of Torrence. An automobile-truck plant, 225x350 ft., costing $500,000, and a traction plow plant, costing $60,000, will be built. Both structures will be of steel and concrete. H. G. Wells is in charge of construction.

The city of Los Angeles, Calif., is considering plans for the construction of a machine shop, costing $30,000, for the Fire Department, at the corporation yards. It is also planned to install a new fire-alarm and police-signal system, costing approximately $150,00.

Gordon Saunders, Whittier, Calif., will erect a commercial garage and machine shop at Philadelphia St. and Newlin Ave., Whittier.

CANADA

The Ohio Motor Car Co., of Cincinnati, Ohio, has completed plans for a factory at Colborne, Ont., where a site has been purchased.

The Canada Steel Goods Co., Hamilton, Ont., has completed plans for a structural steel addition, 80x100 ft., which it will erect at once. The estimated cost is $15,000.

Fire completely destroyed the Brown Copper & Brass Rolling Mills, at New Toronto, Ont., Apr. 7. Loss, $125,000. The loss is covered by insurance, and the plant will be rebuilt. J. F. Brown is the owner.

The Welland Machine & Foundry Co., Welland, Ont., has had plans prepared for the construction of a new foundry, a storehouse and a pattern vault. D. Ross is president.

The Canadian Lock & Novelty Co., New Westminster, B. C., will erect a plant here for the manufacture of locks and all kinds of builders' hardware fittings.

The Dietrich Saw Works Co., Galt, Ont., has acquired a site at Vancouver, B. C., and will construct a branch plant.

GENERAL MANUFACTURING

NEW ENGLAND

Fire in the basement of the Adams-Day Building, Bangor, Maine, on Apr. 5, caused a loss of $5000 to the White Star Laundry.

The city of Hanover, N. H., will enlarge its water-works system.

The George P. Craft's Shoe Co., Manchester, N. H., is considering building an addition to its factory.

The contract has been awarded for the construction of the new automobile tire factory at Lawrence, Mass., for the Tyer Rubber Co., Andover, Mass. Work will be commenced at once and it is expected that the factory will start manufacturing by Aug. 15.

The Mann-Stevens Woolen Co., Brookfield, Mass., is erecting a 1½-story addition to its mills.

The contract for the erection of an addition to the plant of the Star Worsted Co., on Sheldon St., Fitchburg, Mass., has been awarded. The building will be of wood, with a concrete foundation, three stories high.

The city of Framingham, Mass., is considering building an electric-lighting plant.

The city of Holyoke, Mass., is considering enlarging its electric-light plant.

Plans are being figured for the proposed new factory to be erected at the foot of Sargent St., for the Taylor Burt Paper Co., Holyoke, Mass. The plans provide for a brick building, 87x111 ft., four stories and basement. The Samuel M. Green Co., Springfield, Mass., is the architect.

The city of Holden, Mass., will extend its water system.

The Leather Board Co., Milton, Mass., will rebuild its mill recently destroyed by fire.

The city of Salem, Mass., will improve its sewer system.

A building, 125x40 ft., two stories high, to cost about $3000, will be built by citizens of Richmond, Maine, for Bell Bros., Salem, Mass., manufacturers of shoes. The firm will provide the machinery and power.

The dyeing and cleaning establishment of Margaret E. Neylon, 330 Dwight St., Springfield, Mass., was burned, Apr. 3. Loss, about $6000.

The city of Wakefield, Mass., will improve its electric-lighting plant.

The city of West Brookfield, Mass., will extend its water system.

The Simplex Player Action Co., 13 Blackstone St., Worcester, Mass., manufacturer of piano players, has leased additional quarters and will increase its capacity.

C. T. Beardsley, Bridgeport, Conn., has completed plans for an addition to the plant of the American Graphophone Co., on Railroad Ave. It will be two stories and basement, 30x62 ft., of brick.

Plans are being prepared by E. G. Southey, architect, Bridgeport, for a new power house to be built for Charles P. Noyes, at Trumbull, Conn. It will be of brick, tile roof, and will be used as an electric-lighting plant, generating electricity for lighting the Noyes homestead and adjoining buildings.

The G. M. Gilbert Manufacturing Co., Gilbertville, Conn., will build a new boiler house.

The city of Hartford, Conn., is contemplating erecting a new pumping station.

The contract for enlarging the lighting plant of the Meriden Electric Light Co. has been awarded. The building will be 44x95 ft., one story high.

The city of Plainville, Conn., will extend its water system.

The Embalmers Supply Co., Westport, Conn., will build a new concrete factory for the manufacture of embalmers' supplies.

MIDDLE ATLANTIC STATES

The Auburn Thread & Twine Co., Auburn, N. Y., is erecting a one-story brick factory building, 90x200 ft.

The F. F. Dalley Co., Buffalo, N. Y., manufacturer of polishes, has awarded the contract for a three-story addition 70x112 ft.

The contract has been awarded for the erection of a three-story and basement factory building, 70x112 ft., for the F. F. Dalley Co., manufacturer of shoe polish, Military Road and Erie R.R., Buffalo, N. Y., from plans of Foster & Clark, architects, Owens' Sound, Ont. Noted Mar. 7.

The Long Island R.R. Co. has let the contract for the erection of a power plant at Cedarhurst, L. I., N. Y.

The plant of the J. C. Davis Piano Co., Cortland, N. Y., has been damaged by fire to the extent of $250,000.

Fire has destroyed the plant of the Philadelphia Steel & Wire Co., Camden, N. Y. Loss, $165,000.

Fire destroyed the berry basket and crate factory of Augustine Kaley, in Milton, N. Y. Loss, $7000.

The six-story loft building at 258-260 Greene St., New York, N. Y., occupied in part by Cohen, Weiner & Co., clothing manufacturers, was damaged by fire, Apr. 5. Loss, $60,000.

The first floor of the five-story building at 132 Duane St., New York, N. Y., occupied by Merritt-Elliott & Co., shoe manufacturers, was damaged by fire, Apr. 5. Loss, $2000.

The top floor of a five-story building, at 419-421 Broome St., New York, occupied by Jacob Kindlimann, manufacturer of show forms, was damaged by fire, Apr. 10. Loss, $5000.

The top floor of a two-story building, at Gold and Tillary St., New York, occupied by the Adler Chemical Co., was damaged by fire, Apr. 10. Loss, $5000.

The fifth floor of the six-story brick building, at 15 Washington Pl., New York, N. Y., occupied by Greenwald & Miller, manufacturers of hats, was damaged by fire, Apr. 6. Loss, $5000.

The fifth floor of the 15-story building, at 145 West 20th St., New York, N. Y., occupied by the Majestic Manufacturing Co., manufacturer of dresses, was damaged by re, Apr. 6. Loss, $5000.

The Stroock Plush Co., Newburgh, N. Y., will build an addition to its plant.

R. U. Delepenna & Co., Poughkeepsie, N. Y., are receiving bids for a four-story addition to their plant, 60x80 ft.

Fire damaged the four-story building occupied by the Central Laundry & Supply Co., at 5 Lundy's Lane, Rochester, N. Y., Apr. 6. Loss, $5000.

Fire caused a loss of $4000 in the Salem Knitting Mills, Salem, N. J., on Apr. 8.

Fire has destroyed the knitting mill of J. P. Sheppard, Salem, N. J. Loss, $100,000.

Plans have been completed for the construction of a new factory for the Butler Pearl Button Co., Butler, Penn. The structure will be 38x186 ft., one story high.

The plant of the Glen Willow Ice Manufacturing Co., Cinnaminson Lane and the Norristown branch of Philadelphia & Reading Ry., Philadelphia, Penn., was destroyed by fire, Apr. 8. Loss, $150,000.

Fire in the Ararat Dyeing Works, 1240 Vine St., Philadelphia, caused a loss of $1000, Apr. 5.

George Hogg, Philadelphia, Penn., has been granted a permit for the erection of a one-story power house at Milnor and Comby Sts.

William Schluderberg & Son, wholesale provision packers, Third and Bank Sts., Baltimore, Md., are having plans prepared for the construction of a new plant. It will be two stories high, 70x65 ft.

SOUTHERN STATES

The Rappahannock Woolen Mills Co., Laurel Mills, Va., will erect a plant, 51x77 ft., of brick and cement, with reinforced concrete walls.

It is reported that the United States Gypsum Co., 200 Monroe St., Chicago, Ill., is considering the expenditure of $100,000 in the erection of a new plant at Plasterco, Va.

Walter Reaser, Elizabeth, W. Va., will erect a $100,000 plant for the refining of gasoline and the making of lamp black. The factory is to be erected under the name of the Cleveland Natural Gas Co.

A fire in the plant of the B. P. Cook Foundry, Elkins, W. Va., caused a loss of $5000 on Apr. 4.

The Turkey Foot Lumber Co., Huntington, W. Va., will build a railroad from Beattyville, Ky., to Jackson County. A number of sawmills will also be built. C. L. Ritter, of the Ritter Lumber Co., Huntington, is president.

The Atlas Manufacturing Co., Bessemer City, N. C., will enlarge its plant so that a weaving department can be added.

The Fidelity Hosiery Mills, Charlotte, N. C., will erect a brick and stone building, 50x100 ft. Forty knitting machines will be needed.

Plans have been completed by O. A. Robbins, treasurer of the Thayer Manufacturing Co., Charlotte, N. C., for the construction of a new cotton-goods plant. The spinning mill will be two stories high, 150x225 ft., and the weave shed 163x210 ft. J. T. Lincoln is president.

The Johnston Manufacturing Co., Charlotte, N. C., will erect a 5000-spindle coarse-yarn mill. C. W. Johnston is president.

The Highland Park Manufacturing Co., Charlotte, N. C., will erect a 5000-spindle mill for the manufacture of yarns.

I. Frederick Houston Co., Cumberland, N. C., is considering an addition of 8000 spindles to its plant.

Bids will be opened at once for the erection of a three-story, 100x132 ft., brick building, costing $25,000. About 15,000 spindles, with 300 looms and accompanying machinery, costing $150,000, will be installed for the Marion Manufacturing Co., Marion, N. C.

H. M. Shaw, Oxford, N. C., is in the market for carpet machinery for the manufacture of carpets for carriage bottoms.

The Rosemary Manufacturing Co., Roanoke Rapids, N. C., will erect an addition to its mill and sixteen cottages for operatives, Charlotte, N. C. Additional looms will be installed.

The contract for the erection of a three-story, 75x150-ft. winery, of brick, has been awarded by Sol Bear & Co., Front and Marsteller Sts., Wilmington, N. C.

The Glenwood Cotton Mills, Easley, S. C., have awarded the contract and will erect a three-story mill, 105x342 ft., to be equipped with 20,000 spindles and 560 looms.

The Columbus Barrel Manufacturing Co., Columbus, Ga., whose plant was recently destroyed by fire, will erect a larger one. Melville Strauss is president. Noted Apr. 4.

The Telfair Fertilizer Co., McRae, Ga., is planning the erection of a new plant. It will be 175x200 ft., of fireproof construction. The estimated cost is $25,000. M. L. McRae is president.

The Chickamauga Manufacturing Co., Rome, Ga., will erect a large overall factory in the Decaturs.

Arrangements have been completed and site purchased for the construction of two lumber mills near Savannah, by the Great Eastern Lumber Co., Savannah, Ga., and the Day Lumber Co., Dubuque, Iowa.

The Smyrna Cotton, Oil & Gin Co., Smyrna, Ga., will install cotton gins, fertilizer mixer, 150-hp. engine and boiler, and electric motors for its new plant. M. V. Ruff is manager, 409 Rhodes Building, Atlanta, Ga.

W. C. Grove and associates are having plans prepared for the construction of a fertilizer factory at Miami, Fla. The estimated cost is $75,000.

The Bay Minette Land Co., and Newport Mining Co., Milwaukee, Wis., will erect a plant at Bay Minette, Ala. It will cost $100,000, and be devoted to the manufacture of naval stores.

Bids are now being received by the Southern Paper Co., Pascagoula, Miss., for the construction of the main building of its new plant. The structure will be 200x900 ft., of steel and brick.

The Vermillion Sugar Co. has awarded contract and will establish a mill at Abbeville, La., at $300,000.

The Cecelia Sugar Co., Beaux Bridge, La., is having plans prepared for the construction of a 700-ton sugar house. A. G. Broussard is president.

Fire completely destroyed the pump house of the Lyon Cypress Lumber Co., Garyville, La., on Apr. 2. Damage to pumps and machinery, $1000, with no insurance.

The Dixie Laundry Co., New Orleans, La., will erect a modern plant and stables at 1126 Tulane Ave., to cost $50,000. A. S. Picard is president and Max N. Kohler secretary and treasurer.

The Abes & Haspel Co., New Orleans, La., will erect an addition to its plant. Heymas Abes is president.

The Gray & Dudley Hardware Co., Nashville, Tenn., which has secured a site of 22 acres adjoining its present plant, will build an addition to its factories.

The Victoria Limestone Co., Bowling Green, Ky., will install additional machinery, including a 76-in. double-blade diamond saw.

Bids will be received for the new St. Elizabeth's Hospital, Covington, Ky., at the office of the architects, Samuel Hannaford & Sons, about May 1. Total cost to be $750,000. The plans include a combined laundry and power building, 110x70 ft.

The Fullerton Canning Co., Fulerton, Ky., has awarded a contract for the erection of a canning plant. It will be of brick, 80x32 ft., two stories high.

The Henderson County Fruit Growers' Association, Henderson, Ky., will soon erect a cold-storage plant.

Hirsch Bros. & Co., Fourteenth and Grayson Sts., Louisville, Ky., will erect a two-story canning plant, 125x60 ft., at Memphis, Ind. Machinery will be purchased at once.

Two additional turbine pumps will be installed by the city of Paducah, Ky., for the purpose of keeping the sewerage system free of back water from the Ohio River. Thomas N. Hazelip is mayor.

The planing mill of J. T. Cary, Summer Shade, Ky., was damaged by fire, Mar. 27, to the amount of $5000.

MIDDLE WEST

The city of Akron, Ohio, will spend $2,000,000 for a new water-works plant and power-plant equipment will be purchased.

The Alliance Gas & Power Co., Alliance, Ohio, will be in the market for power-plant equipment.

The Enterprise Enamel Co., Bellaire, Ohio, has awarded the contract for an addition to its plant, 60x144 ft., to be built of steel and reinforced concrete.

The Pennsylvania Glass Co., Pittsburg, Penn., has purchased the factory of the McGee-Deiters G'assware Co., Brilliant, Ohio, and will enlarge the plant.

The Willard Storage Battery Co., Cleveland, Ohio, is erecting a $3500 addition to its plant.

The Mechanical Rubber Co., Cleveland, Ohio, maker of rubber goods, will build a large addition to its present plant.

The Beekman Co., Cleveland, Ohio, maker of blankets, will make additions to its factory and equipment.

The Union Paper & Twine Co., Cleveland, Ohio, will rebuild its plant recently destroyed by fire. Noted Mar. 21.

The Sanitary Cup Co., Cleveland, Ohio, will buy equipment for new factory to make a new sanitary drinking cup.

The cooperage of the Greif Bros. Co., Cleveland, Ohio, was destroyed by fire.

The Gund Brewing Co., Cleveland, Ohio, will build and equip a new machine shop.

The Cleveland Worsted Mills Co., Cleveland, Ohio, maker of woolen cloth, will erect a new mill.

The Glidden Varnish Co., Cleveland, Ohio, has purchased additional land to build additions to its plant.

The John C. Roth Packing Co., Cincinnati, Ohio, will build a new box factory at Chattanooga, Tenn.

An artificial ice plant will be installed by the Bavarian Brewing Co., Cincinnati, Ohio.

Extensive additions will be made to the plant of the Boldt Glass Co., Linwood, Cincinnati, Ohio, for the manufacture of machine-made glass bottles.

Contract has been let by the Whitaker Paper Co., for a six-story concrete and steel addition to its present plant at Sixth and Locks Sts., Cincinnati, Ohio.

The Union Gas & Electric Co., Cincinnati, Ohio, is doubling the capacity of its substations at Price Hill and Camp Washington.

Fire gutted the three-story building at Pioneer and Culvert Sts., Cincinnati, Ohio, on Apr. 5, causing loss of $30,000 to the William Barker Machine & Tool Co., the New York Coat & Apron Co., and the American Laundry Co. Loss covered by insurance.

The Columbus branch of the Goodyear Rubber Co., Columbus, Ohio, will erect a three-story building, 37x75 ft.

The Chardon Brick & Tile Co., Chardon, Ohio, will be in the market for complete equipment for a modern brick-making plant. B. F. Pease is manager.

Plans have been prepared and construction will soon be started on the new plant to be erected at Cumminsville, Ohio, for the Scheffle Shoe Manufacturing Co., Hoffner and Delaney Sts., Cincinnati.

The Potters Lumber Co., East Liverpool, Ohio, will buy some wood-working machinery for new mill.

D. J. Albertson, architect, 305 East Main St., Kalamazoo, Mich., is preparing plans for the construction of a new paper mill, for the Sterling Paper Co., Hamilton, Ohio. Four buildings, two stories high, will be erected. The estimated cost is $125,000.

An explosion in the greasehouse of the soap factory of Procter & Gamble, at Ivorydale, Ohio, on Apr. 2, caused fire which resulted in $6000 loss.

The Jewell Grain Co., Jewell, Ohio, will erect a large grain elevator. J. G. Liska is president.

The Aultman & Taylor Co., Mansfield, Ohio, will erect a new shipping building, 62x80 ft., to be used as a loading department.

The Knabe Bros. Co., Cincinnati, Ohio, will rebuild its factory at Norwood.

The broom factory of George Brixler, Springfield, Ohio, was destroyed by fire, Mar. 31. Los, $1000.

A powder explosion destroyed the plant of the Burton Powder Co., Youngstown, Ohio.

The Hunsicker & Bender Mill Co., Bluffton, Ind., was completely destroyed by fire, Apr. 3, with a loss estimated about $10,000.

The Maas-Neimeyer Lumber Co., Indianapolis, Ind., will erect an addition to its manufacturing plant, at 21st St. and Chicago, Indianapolis & Louisville Ry.

The Aetna Cabinet Co., furniture manufacturer, of Indianapolis, Ind., has taken out a permit to erect an additional building.

The Reliance Foundry Co., Richmond, Ind., has been incorporated with a capital of $30,000. The incorporators are E. I. Hunt, G. L. Schultz and Howard Hunt.

The Hollingsworth-Turner Co., South Bend, Ind., has been incorporated with a capital of $100,000 to manufacture and sell ice machines. The incorporators are W. B. Hollingsworth, G. D. Staples and W. M. Hildebrand.

The Inman Box Co., 646 West Willard St., Kalamazoo, Mich., contemplates the construction of a new factory this summer.

The Schulze Baking Co., 108 La Salle St., Chicago, Ill., is having plans prepared for the construction of a new bakeshop, estimated to cost $250,000. The structure will be erected at Yale Ave. and 75th St. It will be four stories, of brick and concrete.

The Aëro Exhibition Co., Chicago, Ill., has been incorporated with a capital of $25,000 to manufacture and sell aëroplanes. The incorporators are Arthur Eastman and O. W. Best, Chicago.

The Engstrom Electrical Manufacturing Co., Chicago, Ill., has been incorporated with a capital of $10,000 to manufacture electrical and mechanical goods. The incorporators are Nels A. Engstrom, George A. Mayer and Ivan Engstrom.

The Rockford Novelty & Fixture Co., Rockford, Ill., will erect a two-story reinforced-concrete factory, 117x185 ft., for the manufacture of store fixtures and furniture. Charles Fredericksen is the president.

W. A. Christianson will erect a large canning factory, Cumberland, Wis. There will be six frame buildings with concrete foundations and floors.

The Heineman Lumber Co. will build large saw and planing mill at Merrill, Wis.

The dry kiln belonging to the Keickhefer Box Co., Sixteenth and South Canal Sts., Milwaukee, Wis., was burned, Apr. 2, with a loss of $800.

WEST OF THE MISSISSIPPI

The Waterloo Canning Co., Dyersville, Iowa, will erect an addition, 65x140, to its factory.

A roundhouse of the St. Joseph & Grand Island Ry., at Hiawatha, Kan., was burned, Apr. 4. Loss, $50,000. G. G. Lacy, St Joseph, is president.

Fire gutted the Fidelity laundry, Fremont, Neb, Apr. 4, causing a loss of $5000 to Hamilton & Smith, proprietors. Loss covered by insurance.

The Skinner Manufacturing Co., Omaha, Neb., will erect a two-story and basement addition, 66x132 ft., to its macaroni factory.

The American Paper Products Co., St. Louis, Mo., is planning to make alterations to its factory at 201-203 Bremen Ave., to cost about $10,000.

The Marrs Manufacturing Co., De Queen, Ark., has been incorporated with a capital of $25,000 to manufacture canning machinery. The incorporators are William T. Marrs, Henry P. George and John T. Carlton.

The Southern Broom Co., Fort Smith, Ark., will erect a large brick factory to replace the one recently destroyed by fire.

A cold-storage plant, laundry and heating plant will be installed in the new Paso Del Norte Hotel, to be erected at El Paso, Tex., at a cost of $700,000. Trost & Trost, El Paso, Tex., are the architects.

Plans have been completed for the erection of a six-ton ice plant for the Floresville Ice & Power Co., Floresville, Tex. It will be of semi-fireproof construction, 35x70 ft. The estimated cost is $10,000. W. G. Rolaff, San Antonio, is the consulting engineer.

The Southwestern Rice Co., Houston, Tex., is having plans prepared for the construction of a new plant. A mill, 48x51 ft., a warehouse 51x276 ft., and a shop will be erected. H. C. Schirmer, 407 Hill St., is president.

Henry Braden, Sequin, Tex., will construct a cotton gin, at Victoria, Tex., at a cost of about $18,000.

F. W. Cotterall, Galveston, who recently purchased the Slayden-Kirksey woolen mill, at Waco, Texas., will improve and enlarge the plant.

The Empson Co., which has plants at Longmont, Fort Collins, Greeley and other northern towns will build a pea-hulling plant at Johnston, Colo., to cost $15,000.

The Artesia Canning Co., Artesia, N. M., will erect a new fruit-canning plant.

WESTERN STATES

The plant of the Globe Paint & Wall Paper Co., 714 Idaho St., Boise, Idaho, was destroyed by fire, Apr. 2, at a loss of $30,000. Insurance, $25,000.

M. P. Bogle, Spokane, Wash., has acquired a site at St. Maries, Idaho, and will erect a new lumbering plant, estimated to cost $250,000.

The Sanpete Knitting Co. plans to construct a two-story brick factory on Center St., Ephraim, Utah. The contract has been awarded.

The Grays Harbor Trunk Co., Aberdeen, Wash., recently incorporated, will erect a plant at Aberdeen. E. N. Partlow and R. H. Keagy are interested.

The city of Milton, Wash., is contemplating the installation of a new waterworks system.

The Yakima Sash & Door Co., North Yakima, Wash., has purchased a site and will erect a factory. C. A. Warnstrom is president.

The sawmill and shingle factory of the Skewis Lumber Co., at Ohop, Wash., was burned, Apr. 4. The plant was owned by F. H. and B. O. Skewis, of Tacoma, Wash. Loss, $40,000.

The Wheeler-Osgood Co., Tacoma, Wash., has started the erection of a wood-finishing and veneering plant. The estimated cost is $50,000.

The Elmira Lumber Co., Elmira, Ore., will move its plant to Portola, Ore. It will be enlarged and new machinery will be installed.

The Wheeler Lumber Co., Wheeler, near Nehalem, Ore., will erect a new plant at Wheeler, which will have a capacity of 150,000 ft. a day.

The plant of the Columbia County Lumber Co., near St. Helens, Ore., was destroyed by fire, Mar. 28. Loss, $25,000.

C. G. Bonner, Fresno, Calif., will construct a new raisin-packing house at Locans, seven miles east of Fresno. The building will be of brick, with concrete floors.

J. B. Brannigan, Newport Beach, Calif., has acquired a site here and will erect a glass factory.

The California Ice Co., 655 Broadway, Oakland, Calif., has had plans prepared for the construction of a new ice plant. It will be erected at First and Market Sts., and will cost $200,000.

The Sperry Flour Co. will erect a two-story mill at San Luis Obispo, Calif., and will install new machinery.

Fire practically destroyed the packing house and barn owned by Secondo Bros., leased by J. J. Voivodich, on West Lake Ave., Watsonville, Calif., on Mar. 24. The packing house owned by A. Balich was partly damaged. Loss, $1100, covered by insurance.

CANADA

Fire did damage to the extent of $20,000 to premises on Lagauchetiere St., Montreal, occupied by R. C. Miller, mill supply agent; Canadian Cocoanut Co., W. J. Kearns, printer; John Fee, machinist, and Dominion Lithographing Co.

The Sayers Co., Montreal, Que., is constructing additions to its plant.

New Incorporations

The following companies have been incorporated to manufacture:

The Linograph Co., Augusta, Maine; printing-office machinery. Capital, $1,000,000. E. M. Leavitt is president and treasurer.

The Auto Tractor Co., Augusta, Maine; to manufacture, buy and sell machinery. Capital, $100,000. L. J. Coleman, Augusta, is president and treasurer.

The Cable Wire Fence Co., Augusta, Maine; fence machines and cable woven wire fences. Capital, $50,000. E. M. Leavitt, Augusta, is president and treasurer.

The Buckeye Iron Co., Columbus, Ohio; iron and steel products. Capital, $10,000. Incorporators, H. W. Bradshaw, A. E. Cather, B. J. Hood, H. L. Richards and C. E. Davies.

The United Foundry & Machine Co., Bridgeport, Conn. Capital, $200,000. Incorporators, William C. Buckelew and Phillip Dumphrey Beach, Bridgeport, and Andrew Steen, New York, N. Y.

Forthcoming Meetings

American Supply and Machinery Manufacturers' Association, National Supply and Machinery Dealers' Association, Southern Supply and Machinery Dealers' Association. Triple convention, May 13-15, Norfolk, Va., Hotel Monticello. F. A. Mitchell, secretary, 309 Broadway, New York City.

Master Boiler Makers' Association. Sixth annual convention, Fort Pitt Hotel, Pittsburg, Penn., May 14-17. J. Rogers Flannery, secretary arrangements committee, Flannery Bolt Co., Pittsburg, Penn.

National Machine Tool Builders' Association. Semi-annual convention, May 16-17, Atlantic City, Hotel Chalfonte. Charles E. Hildreth, secretary, Worcester, Mass.

American Society of Mechanical Engineers. Spring meeting, May 28-June 1. Hotel Hollender, Cleveland, Ohio. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

American Railway Tool Foremen's Association. Annual convention, Chicago, Ill., July 9, 1912. H. L. Mills, secretary, 835 Monadnock Building, Chicago, Ill.

American Society of Engineer Draftsmen. Regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies Building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton Building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

MEN WANTED

Connecticut

PATTERN MAKERS—Six first-class, familiar with heavy machinery work. Farrel Foundry & Machine Co., Ansonia, Conn.

PRODUCTION MAN, first-class, capable of handling the product of a factory of 125 employees; must be familiar with piece work, and of good executive ability; give references and salary expected. Box 204, Am. Machinist.

SALESMAN—Must be an engineer accustomed to selling machinery, and not over 35 years old; headquarters will be in St. Louis, with charge of all states south of Illinois and Nebraska; we must have a first-class man. Apply stating experience to Box 218, Am. Machinist.

DESIGNER—High-grade man for automatic wire- and metal-working machinery; preference will be given to a man who has had practical experience building and making tools for this class of machines; give outline of experience, wages expected, etc. Box 161, Am. Mach.

FOREMAN, to take charge of bolt-threading department; must thoroughly understand thread cutting in all particulars, also the operation of the various types of threading machines, and be competent to manage help; only first-class man need apply. Box 165, Am. Machinist.

Illinois

WE ARE constantly in need of the services of first-class draftsmen and tracers; some men are required on tool work and it is possible to place some on detailed and assembled drawings of agricultural implements. Applications requested addressed David Bradley Manufacturing Works, Bradley, Ill.

TOOLMAKER FOREMAN, conversant with uptodate methods in tool and die making for line of machines similar to typewriters, adding machines and cash registers; must have expert mechanical and executive ability, good habits and capable of handling a department of 30 tool makers; give age, references and full particulars. Box 188, Am. Machinist.

Iowa

TOOL MAKERS on gas-engine jigs; punch and shear man on metal manure spreader; age, experience and wages expected. Address "Superintendent," Lock Box 317, Mason City, Ia.

Maryland

DRAFTSMAN, experienced on high-speed stationary engines. Box 112, Am. Machinist.

DRAFTSMEN, experienced on dredging machinery and marine work; also competent structural and hull draftsmen. Box 59, Am. Machinist.

Massachusetts

DRAFTSMAN—First-class on cotton-carding machinery. Apply stating age, experience and wages expected, to Box 155, Am. Machinist.

OPERATORS on Potter & Johnston and Gridley automatics; in writing state age, experience and pay desired. Box 156, Am. Machinist.

FOREMAN for milling machine department; an energetic, uptodate man of experience on medium and light work of commercial quality; in writing state wages expected, age and experience. Box 157, Am. Machinist.

DRAFTSMAN, experienced with electrical or high-speed steam-engine experience for a permanent position with a large manufacturing concern near Boston, Mass. Apply stating age, education, experience and salary expected by addressing "Chief Draftsman," Box 139, Am. Machinist.

Michigan

SUPERINTENDENT—A man fully qualified by long experience to take charge of the sheet-metal department of a large automobile factory in the Middle West; must understand the manufacture of metal bodies as well as all other sheet-metal automobile parts; write full details of experience, age, salary expected and give references. Box 213, Am. Machinist.

Missouri

TOOL DESIGNERS, experienced on jig and fixture work; state experience and wages expected. Box 203, Am. Machinist.

New Jersey

DRAFTSMEN, preferably with some experience in machine-tool design. Address Box K, Plainfield, N. J.

New York

HARDENER, first-class, accustomed to tool steels and case-hardening; state experience, reference, wages expected. Box 190, Am. Machinist.

MACHINERY DRAFTSMAN and designer, first-class on automatic and special machinery; state references, experiences and salary expected. Box 175, Am. Machinist.

FOREMAN for automatic and turret lathe department; must be a hustler, thoroughly experienced and able to produce accurate work at the proper cost; steady position for the right man. Box 150, Am. Machinist.

MECHANICAL DRAFTSMAN, thoroughly competent, who has a complete knowledge of flour blending, sifting and weighing machinery; give experience, references, salary expected, etc., in first letter. Address "Machinery," Box 189, Am. Machinist.

ASSISTANT TO SUPERINTENDENT, experienced in management and keeping of cost system; moderate salary to begin; excellent chance of advancement. Address with full particulars and salary desired, "Manufacturer," Box 429, 99 Meserole Ave., Brooklyn, N. Y.

DESIGNER on special machinery; one who possesses original ideas and has inventive ability; preference will be given to a man understanding designing jigs and fixtures to cut down cost; modern shop in greater New York; permanent position; state particulars and salary desired. Address "Bakers' Machinery," Am. Machinist.

FOREMAN for general machine shop employing 50 hands; must be first-class mechanic, good organizer and capable of producing work cheaply in plant which has been operated heretofore without much system; shop is well equipped with modern tools, is always busy, and only lacks a capable foreman who knows how to handle his men to advantage; to man who can better conditions we will pay good salary; state full particulars in your reply. Box 197, Am. Machinist.

Ohio

SALESMAN, experienced, for Middle West, competent to furnish estimates and negotiate sales for presses, dies and equipment used in manufacturing sheet and bar-metal products; experienced men only need apply. Box 71, Am. Machinist.

CAPABLE MAN with mechanical experience, familiar with factory costs and efficiency work, by a large manufacturing concern of mechanics' small tools, in the Middle West; good position for right man; give full information as to experience, references, age, married or single, salary expected, etc.; only those qualified for this particular work need apply. Box 212, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

South Carolina

DRAFTSMAN, good mechanical, with technical education, who has had experience in steam-power plant work. Shand Engineering Co., Columbia, S. C.

Wisconsin

ESTIMATOR, capable of setting exact time of operation on small interchangeable and repetition work from blueprints; automobile part experience preferred, though not essential; give full particulars and salary expected. Box 171, Am. Machinist.

FOREMAN, to assist general foreman of tools in automobile-part manufactory; must have thorough knowledge of modern jigs, fixtures, punches and dies, and have successfully held a like position on automobile parts, or equal; state full particulars and salary expected. Box 222, Am. Machinist.

FOREMAN, to take complete charge of grinding section in automobile-part manufactory; must have successfully handled such a position on automobile parts or equal; this section includes universal, surface and rough grinding, also polishing; state full particulars and salary expected. Box 221, Am. Machinist.

Foreign

MACHINE SHOP SUPERINTENDENT wanted for large motor factory in Coventry, England; first-class man who has had considerable experience in machine-shop organization; good salary will be paid to a thoroughly competent man. Apply giving full particulars, etc., Box 34,142 Haddon's Advertisement Offices, 132, Salisbury Square, London, England.

TOOL MAKER for St. Petersburg, Russia, first-class, on high-grade machinery; one experienced in making tools, jigs and fixtures for Cleveland automatic and Warner & Swasey turret machines; one who speaks German or Russian language preferred; works enlarging; may become department superintendent if capable of handling men; write full details, giving experience, references and salary expected: Pneumatic Tool Co., St. Petersburg, Russia; W. F. McColl, superintendent, formerly with Mergenthaler Linotype, Brooklyn; Noiseless Typewriter Co., Middleton; General Electric, Lynn; American Optical Co.

Positions Wanted

Connecticut

TOOL DESIGNER wishes permanent position; thoroughly practical draftsman and tool maker; would favor a position as assistant to superintendent of small manufacturing company; location, New England or Eastern New York preferred. Box 196, Am. Machinist.

Illinois

GENERAL FOREMAN or foreman; 23 years' practical uptodate experience large or medium work; Middle West preferred; employed; A-1 references. Box 215, Am. Machinist.

GENERAL SUPERINTENDENT, at present having entire charge of 200 employees in a medium sized factory, would consider a proposition in the same capacity or as that of factory manager with a concern manufacturing typewriters, adding machines, office devices, interchangeable machinery, etc. Advertiser is a high-grade, practical executive and thoroughly understands the application of modern methods to the organization and management of a factory; exceptional results attained in present position; highest references from present and former connections. Box 193, Am. Machinist.

Massachusetts

BLACKSMITH FOREMAN on all kinds of forgings, tools and case-hardening; 12 years' experience; will go anywhere. Box 220, Am. Machinist.

MECHANIC AND DRAFTSMAN, all-round, wishes position affording opportunity to market first-class ability for experimental work; strictly temperate; capable of designing and building complete machine and tools; over 15 years' experience. Box 205, Am. Machinist.

GENERAL FOREMAN, American, age 31, desires change; expert mechanic and manager; uptodate methods of tool making and machine manufacturing; thorough knowledge of piece work, premium system and estimating; would like to take charge of small concern where a progressive man is needed; salary, $2000; best references. Box 207, Am. Machinist.

GENERAL FOREMAN or similar position wanted by first-class mechanic who has proved ability as such; age 41, and 20 years' experience; accustomed to handle large bodies of men to advantage; has produced a number of labor-saving devices for large prominent concerns manufacturing engineering specialties, including valves, fittings, etc.; proof of, with the best of references will be given to party interested; any state; no punch and die man. Box 214, Am. Machinist.

Michigan

DRAFTSMAN, with plenty of practical experience, desires change; qualified for stoker design, vacuum pans and general drafting. Box 208, Am. Machinist.

CHIEF DRAFTSMAN or designer, now holding responsible position with one of the leading automobile companies, desires change; nine years' practical experience on automobiles; expert gas-engine designer, capable executive, member S. A. E. Box 194, Am. Machinist.

New Jersey

MECHANICAL ENGINEER, designer, eight years' experience on water turbines, hoisting and hydraulic machinery, desires position. Box 210, Am. Machinist.

TOOL MAKER and machinist, 40, 23 years' experience automatic machinery, experimental and die work, wants position; executive ability, handling help. Box 206, Am. Machinist.

ENGINEERING and sales position wanted by young technical school graduate, 28 years of age; have had seven years' practical experience including shop, engineering and sales; would like to get in touch with growing concern which requires services of a first-class man. Box 217, Am. Machinist.

New York

MECHANICAL DRAFTSMAN, various experience, wishes position. Box 209, Am. Machinist.

FOREMAN, middle age, up to date on modern methods, pumps, electrical and general machinery; can get results. Box 159, Am. Machinist.

SUPERINTENDENT and manager of large concern desires change; have made good in present position for nine years. Box 168, Am. Machinist.

MECHANICAL DRAFTSMAN, with three years' technical training and one year's practical experience, desires position. Box 200, Am. Machinist.

SUPERINTENDENT or general foreman, thorough mechanic and producer, wishes position, any high-grade machinery or automobile factory. Box 219, Am. Machinist.

MACHINE DESIGNER, 30; 11 years' experience in wrapping, weighing and tool machinery, development of inventions, etc., desires responsible position. Box 173, Am. Machinist.

MECHANICAL DRAFTSMAN, technically educated, three years' experience in design of valves and engineering specialties, desires change. Address "R. E. M.," 8 Schubert St., Binghamton, N. Y.

MECHANICAL SUPERINTENDENT, reliable and well educated, good executive, large technical and practical experiences in designing and building labor-saving special machinery and machine tools, running plant economically, desires change to broader field with opportunity for his ability; prefer New York or vicinity; age 32. Box 199, Am. Machinist.

SUPERINTENDENT, tool designer; married man, age 33 years; a thorough mechanic, experienced as machinist, draftsman and executive on machine tools, electrical, hydraulic, transmission and experimental machinery; has record as production superintendent where keen competition has made low cost and improved product imperative; would connect with live concern where ability and push will have its legitimate results. Box 195, Am. Machinist.

MECHANICAL ENGINEER, age 40; advanced from shops to foreman, chief draftsman, superintendent, chief engineer, and managing all departments with three millions annual business; energetic and capable in matters of light and heavy forged, cast and sheet metal, and wood manufacturing; power plants, labor, costs, systems, sales and general business; wide experience; modern methods; reasonable compensation based upon conditions. Box 216, Am. Machinist.

GENERAL MANAGER—Highly educated mechanical engineer, still general manager of a big concern in Europe, would like to get position here as general manager in a large manufacturing or power plant; speaks English, German, French, Hungarian; has 10 years' practical experience in gas, steam, oil engines, heating and ventilating installation. First-class organizer, who can bring your executive costs down to a minimum in relation to the output, which will make him paid easily; salary about $6000 and interest in dividends; agents forbidden. Box 211, Am. Machinist.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

MACHINE DESIGNER and estimator, 12 years' various machine work, is open for engagement. Box 198, Am. Machinist.

CHIEF MECHANICAL ENGINEER of large manufacturing plant and open-hearth steel mill employing 2000 desires change; satisfactory reason for changing; college graduate and practical experience; best references; salary, $3600; Eastern location preferred. Box 185, Am. Machinist.

Pennsylvania

CHIEF TOOL DESIGNER desires position. Box 186, Am. Machinist.

Wisconsin

COST MAN, age 30 years; 10 years' experience with big manufacturing concern, where at present employed. Box 202, Am. Machinist.

SUPERINTENDENT, by a production engineer, now with company producing heavy machinery and employing 1200 men; can increase output and decrease cost in a systematic way. Box 167, Am. Machinist.

MECHANICAL ENGINEER, with 12 years' experience, desires increased opportunities; a good designer, accustomed to handling men; experienced in shop organization and in developing systems for increased production. Box 166, Am. Machinist.

Miscellaneous

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Production increased, quality improved. James F. Hobart, efficiency engineer, Box 133, Am. Machinist.

Broken machinery welded and guaranteed. Waterbury Welding Co., East Waterbury, Conn.

For Sale—One Rand high-pressure imperial type No. 11 steam pump. Box 192, Am. Machinist.

Drill grinding fixture having large European sales; license for United States offered. Box 184, Am. Machinist.

For Sale—One Niagara duplex steam pump; capacity, 30 cu.ft. per minute.; in first-class condition. Box 191, Am. Mach.

Mechanical designing and engineering; ideas developed; drawings made; correspondence invited or call. Fred S. Carver, 32 Treat Place, Newark, N. J.

Small patented article to manufacture and market wanted; give full particulars, special points of merit, etc; will pay royalty. Box 201, Am. Machinist.

For Sale—One large Spencer automatic machine, suitable for making brass or iron fittings. Apply Wahle, Phillips Co., 551 West Fifty-second St., New York City.

Machine shop in New England, fully equipped, wants to contract for small, light machinery; good foundry facilities and can turn out work quickly. Box 153, Am. Machinist.

For Sale—One 4¼ Cleveland automatic machine, also one 2¾ Cleveland automatic, and one No. 1 Brown & Sharpe universal grinder, in first-class condition. Address The Standard Machinery Co., Mystic, Conn.

Machine shops and foundries desirous of manufacturing and marketing a profitable specialty, in the line of fixture, device or machine requiring but little capital, should communicate with the Engineering Service Co., Box 463, Williamsport, Penn.

Machine shop for sale in New England, manufacturing a standard line of well known machine tools; we own the buildings and lot, 75x150 ft., and are a going concern. Box 154, Am. Machinist.

Drawings, specifications, estimates and manufacture of jigs, fixtures, automatic machinery, special equipments, punches and dies by a corps of experts; write us your requirements for suggestion of ideas and cost estimates. Laurin & Sundstrom, 271 Hicks St., Brooklyn, N. Y.

For Sale—Fully equipped plant, situated in Ohio, consisting of brick building of 30,000 ft. floor space and three acres; with this plant is an established business, and the equipment is adapted for the manufacture of machine tools, gas engines, or metal manufacturing, in which gray iron and steel would constitute the product; there are good reasons for selling this first-class proposition, and quick action is necessary. Address J. N. Wilson, Box 187, Am. Machinist.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

Talks With Our Readers

By The Sales Manager

There was some "good stuff" in an article on "Honesty in Advertising," in the New York "Globe" the other evening. It was written by Bert M. Moses, President of the Association of American Advertisers, and was so interesting that we are going to reprint it here:

"So far as can be learned from History, the wail of the world has ever been for honest men.

"With honest men in control, every problem that has confronted civilization from the Beginning to the Now would be solved.

"There would be no poverty, no crime, no wars, no epidemics, no race or religious hatreds, no discordant note anywhere.

"No one has ever undertaken to count the laws that have been passed to make honesty compulsory.

"These statistics, however, are available: In the year 1910 alone there were passed by the Federal and State Legislatures over 44,000 new laws.

"A law is something whose purpose is to compel people to do or not to do certain things.

"A law, if just, aims to make men do that which they would do without law if they were honest.

"So it seems that a great majority of the enactments passed have as their object the promotion of honesty.

"What has been the result of all these hundreds of thousands of laws?

"Is honesty any more of a glut on the market than it ever was?

"The trouble has been this:

"The law never changed human nature. It never made anybody permanently honest.

"Mankind cannot be legislated into goodness. Morality does not find its source in a Legislature, but must leap straight from the heart.

"Just now there is a nation-wide movement to make advertising honest.

"Every decent man in America is supporting that movement, and all over the land advertising clubs and associations are lifting up their voices in favor of it.

"Perhaps a majority believes the remedy lies in the law

"Others feel that there is a better way, and an only way.

That way is the Power of Public Opinion.

"Ten years ago dishonest, deceiving and false advertising was at its zenith.

"Exaggeration, falsehood, and plain lying were universal.

"The fakir and swindler were not the only offenders, but practically every advertiser indulged in extravagant and unwarranted forms of speech in promoting his wares

"Then the real work of reform started.

"Publishers began to refuse that particular form of advertising which was fraudulent on its face.

"More and more closely was the copy scanned as time passed, until today the professional swindler finds his way so almost completely barred that his vocation of collecting coin by fraudulent advertising is about gone.

"There still remains that semi-respectable form of advertising that deals largely in superlatives and exaggeration. But progress upward has been rapid, and it has come about, not because of law, but because men are learning without enactment that honesty is a paying proposition.

"They are learning that truthful advertising, which the public believes, 'pulls' better than misleading advertising that the public suspects.

"Public opinion is a power above and beyond laws, and, so far as I can learn, no law ever made public opinion.

"Laws are for lawyers.

"Once get advertising into their hands, and the issue will be so clouded that no man will know what he may or may not say in public print.

"Truth is a point of view, and in all History no man has yet appeared who was wise enough to say, 'This is surely so, or that is surely not so,' in the matter of merchandise.

"Public Opinion is at work, and its influence is widening and broadening daily.

* * * *

Only reliable products can be continuously advertised.

Manufacturing Cream Separators

By F. A. Stanley

Standard and special tool equipment utilized by a large establishment in Iowa for producing dairy separators at the rate of 65,000 per annum.

Facing frame bottoms on the miller; boring bearings for bowl spindles, with a full set of drills, reamers and piloted cutter bars used in the driller.

Making milk pans by drawing and spinning; balancing and testing bowls running at high speed.

One of the largest machine plants west of the Mississippi River is the Iowa Dairy Separator Co.'s works, at Waterloo, Iowa. As its name indicates, this company is engaged in the manufacture of cream separators. Two types of machines of this nature, built by it, are illustrated in Figs. 1 and 2, which also show in detail the separator mechanism, including the gearing, bowl spindle, bearings, bowl, etc.

The factory for producing these separators is fully equipped with standard machine tools, special machinery, and jigs and fixtures without number. There is such a variety of this latter class of tools that a complete presentation of their features in these columns is an impossibility. However, a liberal selection has been made from the wealth of material available at the plant, and a large number of views will be included in this and the succeeding article, showing typical operations and methods in the different departments.

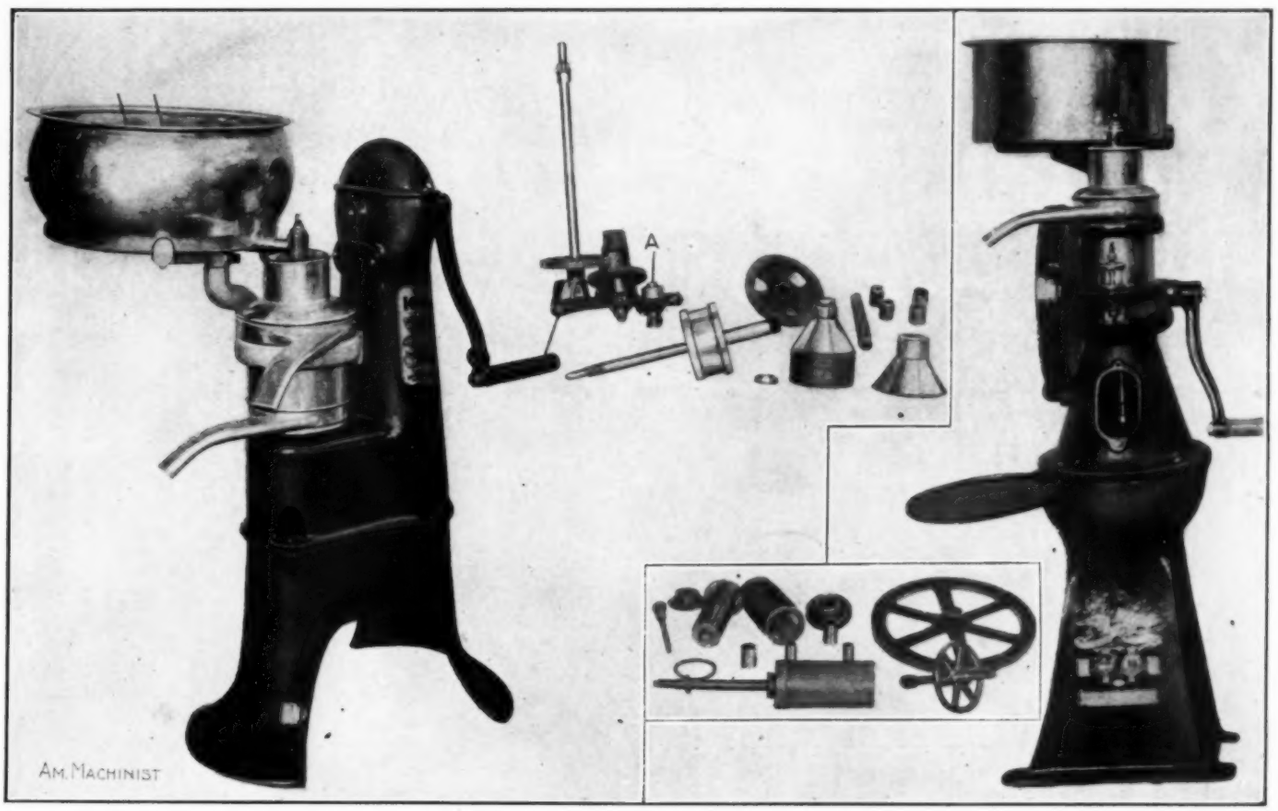


FIG. 1 TWO TYPES OF CREAM SEPARATORS FIG. 2

FEATURES OF DESIGN

Referring to the machines in Figs. 1 and 2, it will be seen that there are several important differences in the design of the two separators. For example, the frame casting of one is carried up to a point above the bowl and houses in the driving gear completely; while in the other design the gear is inclosed in a neat case at the side of a somewhat lower frame, and the large receptacle for the milk is supported upon an upright casting, which is bolted to a flat surface provided at the rear of the conical portion of the frame. The illustrations will show, among other things, the methods of machining the two types of frames, as well as the offset casting forming the milk-pan support of the separator in Fig. 2.

Naturally there is considerable difference in the arrangement of the gearing in the two designs, also in the forms of the bowls, spindle bearings, etc., as will be noticed upon inspection of the group of parts beside each separator.

MILLING THE BOTTOM OF A FRAME

The first machining operation illustrated is the milling of the lower surface of the frame for the separator shown in Fig. 1. This is accomplished with the aid of the fixture represented in position on the miller in Fig. 3.

The fixture is so constructed that the body of the casting to be milled is supported in a horizontal position and is clamped down from the top by setscrews carried in two swinging straps. Thumbscrews are provided at the side and end and there is no possibility of the work shifting under the action of the cutter. The latter is a face mill with a shank fitting directly in the miller spindle. The surfaces to be milled consist of three bearing pads of moderate proportions, so that a large face mill is not required in the operation.

THE SPINDLE BEARING IN THE FRAME

The equipment for boring the openings in the upper and lower walls of the offset portions of the frame is seen in Fig. 4. The upper opening is to receive a hub at the bottom of the cylindrical pan, which

surrounds the revolving bowl; the lower opening is a seat for the bearing in which the lower end of the bowl spindle runs. This bearing is seen at *A*, in the group of parts in Fig. 1, and as there shown, is carried by a gear plate which is attached as a unit to the bottom of the frame when the machine is assembled, the hub at *A* fitting tightly in the hole bored in the lower wall of the frame.

This lower spindle bearing consists of a bushing bored to receive the reduced end of the bowl spindle and carrying a steel ball, upon which rests the rounded end of the spindle. The ball in turn rests on a similar seat formed on the end of an adjusting plug, which closes the bottom end of this step bearing.

The Boring Tools and Fixture

It is essential that the two openings bored through the upper and lower walls of the frame shall be exactly in line with each other, and consequently the tools for the work are designed with this end in view.

The method of securing the frame casting in the boring fixture under the driller will be seen upon examination of Fig. 4. The tools for the two sizes of holes in the frame (the upper opening is about double the size of that for the lower spindle bearing) are shown on the stand to the right of the driller. These include a centering plug and bushing for positioning the work in the fixture at the outset, a drill for opening out the lower hole, a pair of roughing and finishing boring bars, each with two cutters, one for the upper hole, one for the lower; and two single reamers, one for each bearing seat.

Details of Bars and Reamers

One of the boring bars with its two flat cutters is represented in the machine spindle in Fig. 4. The lower end of the bar is piloted at the bottom of the fixture, and the upper end is splined and guided in a cast-iron bushing, which enters a fixed hardened-steel bushing in the top of the fixture when the boring bar is run down into working position. The cast-iron bushing thus rotates with the bar, to which it is connected by a feather.

The finishing bar is arranged in similar fashion. It is followed in operation by the reamer for the upper hole, and then the smaller reamer for the lower bearing seat is brought into service. As shown, this reamer has a long bushing, the lower end of which fits the reamed hole in the work, while the body of the bushing fits the fixed bush in the boring fixture. The bushing supports the reamer all the way down to the work, and thus assures alignment of the two seats bored through the frame.

Another Fixture for Frames

A fixture for holding the separator frame while the two bearings opening at the top are being drilled and bored, is shown in Fig. 5. The bearing bored

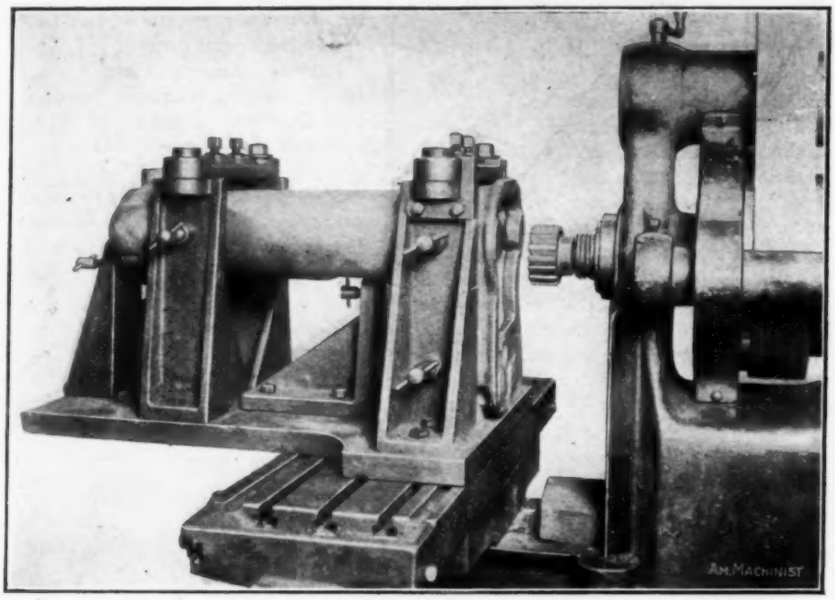


Fig. 3. Facing Bottom of a Separator Frame

Fig. 4. Jig for Boring Center Bearing in Separator Frame

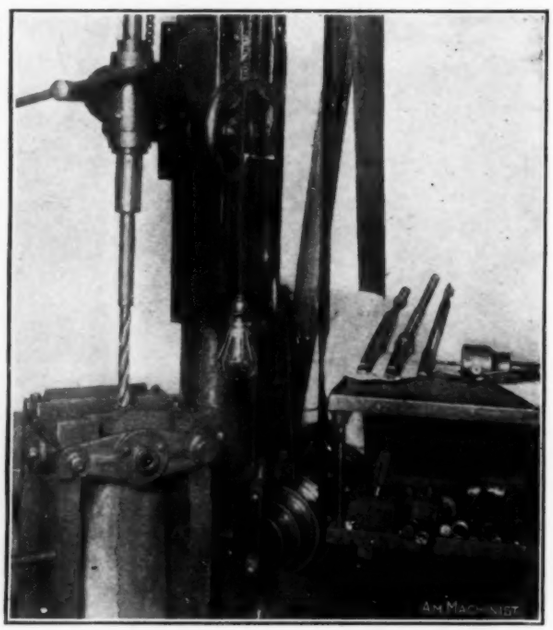


Fig. 5. Jig for Separator Frame

through the bushing in the top of the fixture receives the upper end of the vertical shaft in the group shown at *A*, Fig. 1. The hole bored crosswise in the frame is for a short driving shaft, which is operated by the handcrank, and which carries a large bevel gear, meshing with the pinion on the vertical shaft. Holes are also drilled in the top of the frame to receive the screws for holding the cap which covers the bevel gearing.

The method of locating the work in the jig and the means of guiding the tools assure correct alignment, one with another, of the different bearings in the frame, so that scraping and fitting in assembling are reduced to a minimum.

The separator frames and other parts are put through the shop in very large lots, the plant having an annual output of no less than 65,000 complete machines. Some idea of the quantities undergoing manufacture will be gathered from Fig. 6, which is a view in one end of a department where large numbers of frames, gear cases, etc., await withdrawal to the assembling room.

FIG. 6. SEPARATOR FRAMES AND OTHER PARTS

MAKING PANS

The milk pan on the separator in Fig. 1 is formed with bulging sides, giving it a spherical appearance between base and flange. This utensil, like the plain one on the other separator, is drawn up in Bliss double-action toggle presses from $\frac{1}{16}$-in. sheet blanks cut to diameter with a rotary shear. The first press receives the circular blank and draws it up to the form of a shallow pan. The next press redraws it to depth and flanges the open end.

The pan is formed to the bulging outline in the spinning lathe, Fig. 7, the tools for which are represented more clearly in Fig. 8. The roll at the outside of the work is formed to the correct section for the pan and the inner roll is fed to the work to force it out to the outer roll by the hand lever and cam on the tail spindle, which carries the inner roll. The same machine is used for trimming the flange and rolling over the edge with the cross-slide tools.

The finished pan is annealed thoroughly to eliminate all possibility of its cracking from internal strain when in service.

BOWL REQUIREMENTS

The pans and the bowls are tinned by a dipping process in a department equipped with suitable tanks, acid baths and other apparatus. The bowls themselves when in operation on the separators are rotated at a very high rate of speed, and for this reason they must be strong and without flaws to resist bursting tendencies, due to centrifugal force; they must also run in perfect balance when secured to their spindles.

The bowl is drawn up from $\frac{1}{8}$-in. soft steel in a series of operations, each drawing being preceded by annealing of the material. The plain cylindrical bowl shown on the spindle for the machine in Fig. 2, is about 7 in. deep, and six separate drawing operations, with as many annealing processes, are required in its production.

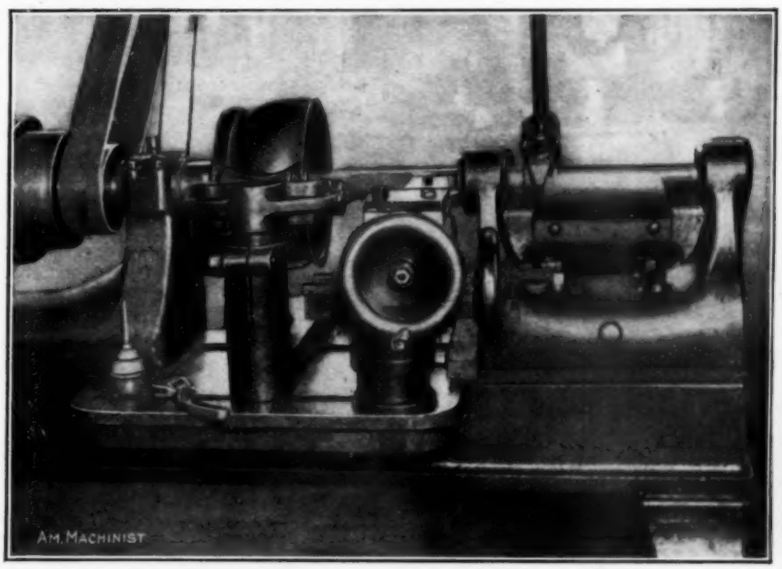


FIG. 7

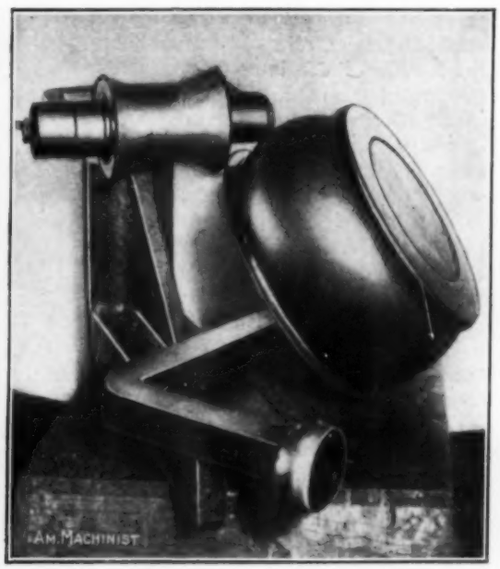


FIG. 8

EQUIPMENT FOR SHAPING PANS

THE BALANCING DEPARTMENT

All bowls are balanced on parallels, and then secured to their spindles and tested for running balance on the machines in the department illustrated in Fig. 9. Here the spindles are driven at high speed, and the bowl, which is surrounded by a guard when running, is tested and corrected for any lack of balance until it runs perfectly true.

The balancing medium is a small quantity of solder, which is applied in a thin flat lump at the required spot, and then worked down with a scraper until a true balance is secured. The solder is so thin and so smoothly worked down in the balancing process, that it is not visible to the eye, and hardly perceptible to the touch.

All separators prior to shipment are driven for several hours under belts in the department shown in Fig. 10.

The greater part of this article has been devoted more particularly to a description of the operations on separators of the type illustrated in Fig. 1, though in several cases similar processes are employed for machines of the class in Fig. 2. In another article, to appear shortly, a detailed account will be given of certain special methods employed in the manufacture of the latter type of separator.

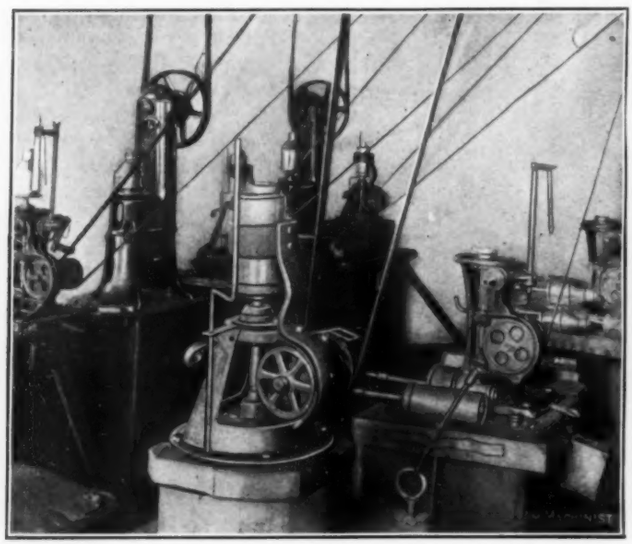


FIG. 9. BOWL-BALANCING DEPARTMENT

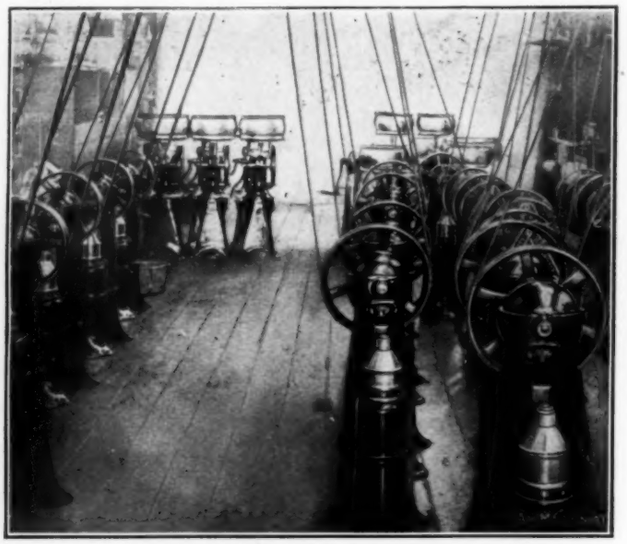


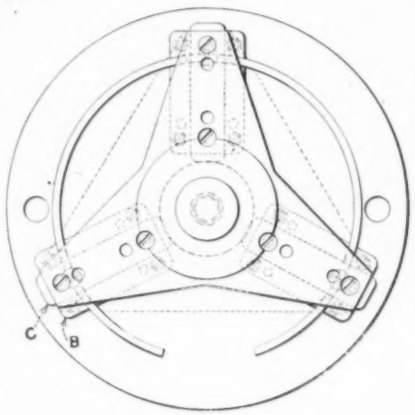
FIG. 10. "RUNNING-OFF" DEPARTMENT

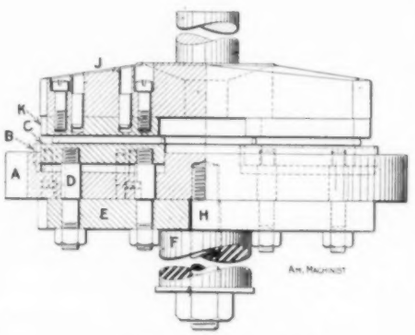
Press Tools for an Offset Wire Ring

BY ARON LAWRENCE

For the commercial production of duplicate parts in large quantities, many ingenious tools are devised. Belonging to this class is a press tool for the production of a steel ring of $\frac{1}{16}$-in. wire containing three offset portions or humps at 120 deg. apart.

The ring in question is shown in position in the die in Figs. 1 and 2, by reference to which the character of the offsets is plainly seen. The die for the production of the ring is shown in section, Fig. 2, in which *A* represents a cast-iron base plate of circular form and uniform thickness, into which are bedded the forming or offsetting die strips *B*, which are made of hardened tool steel and secured to the base *A* by fillister-head screws and dowel pins.





RING-OFFSETTING DIE

A steel stud *H* is screwed into the under central portion of *A* and carries at its lower extremity the usual nut and washer in conjunction with a heavy rubber bumper *F*. Superimposed on the bumper *F* is a cast-iron pressure plate *E* carrying, at approximately 120 deg. apart, suitable shoulder steel studs *D* fastened to it with nuts below, and carrying at their upper extremities the hardened tool-steel stripper plates *C* which slide vertically between the die strips *B*.

The upper portion of the die comprises a star-shaped punch-carrier *J* which is provided with a shank or stem for attachment to the press ram. Attached to its under surface at the arm extremities are the three hardened tool-steel forming bars *K* held in position by heavy fillister-head screws and dowel pins. The action of the tool is as follows:

When the press ram is up with the rubber bumper extended and the stripper bars *C* at their upper position, the operator merely lays the wire ring, which has previously been coiled and cut off to size, in a spring coiling machine, in position on the die with the open part of the ring facing him, after which the press is tripped by the foot pedal; the ram descending pinches the wire firmly between the stripper bars *C* and the forming bars *K* and then proceeding downward together bends the wire across the die strips *B*, thus producing the desired offsets.

According to a report recently issued by the Census Bureau, there were 240,000 wage earners employed during 1911 in iron and steel works and rolling mills. There was an increase of 31 per cent. in the number of employees during the decade from 1899 to 1909. The value of the products of these plants increased by 65 per cent.

Air Valve, Piston and Bushing Work

By Ethan Viall

A number of multiple-spindle profiling machines for slide valves and bushings.

Turning cock keys, boring bushings and drilling valve slides with the use of a stepped block.

Some very interesting machines are in use in practically every department of the great Westinghouse Air Brake shops, in Wilmerding, a short distance out of Pittsburg, Penn., but none is of more interest than the multiple-spindle profiling machine used for milling the ports in air-brake slide valves and bushings.

One of these profiling machines with seven spindles, and equipped with pneumatic chucks, is shown in Fig. 1, the details of the chucking and operating mechanism being more plainly shown in Fig. 2.

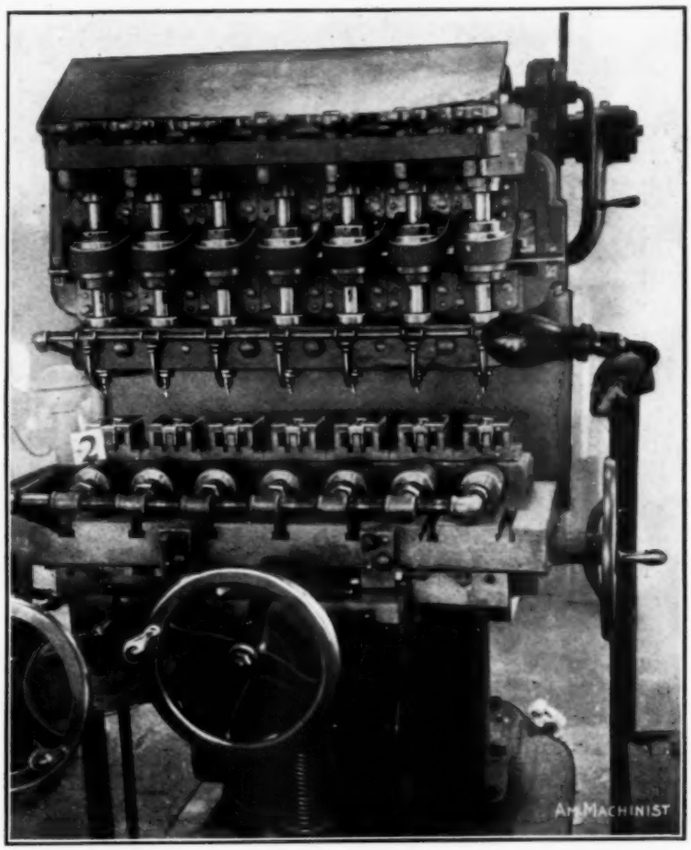


FIG. 1. SEVEN-SPINDLE MACHINE FOR MILLING PORTS IN SLIDE VALVES

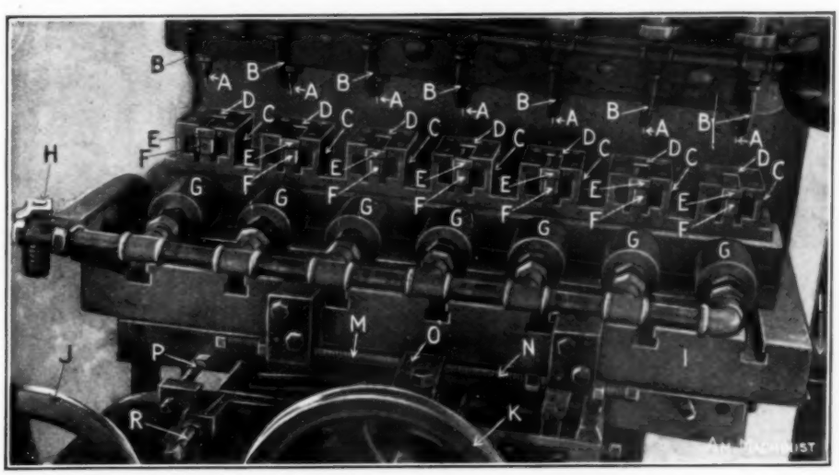


FIG. 2. DETAILS OF SLIDE-VALVE CHUCKING MECHANISM

In the halftones, *A* indicates the small end mills, and *B* the air nozzles used for blowing chips out of the cuts. The chucks *C* consist of boxlike castings, to the top of which the hardened-steel plates *D* are doweled and fastened by four fillister-head screws. These plates are slotted so that when the surfaced part of the brass slide valves is forced up against the underside of the plates, there is sufficient open space for the mills to cut out the ports without striking the edges of the slots.

The valve slides *E* are forced up against the top plates by the beveled slides *F*, operated by pistons in the air cylinders *G*, the valve slides simply being pushed in by hand as far as they will go, straddling the blocks. The air is then turned on from the valve *H*, which forces the pistons in the cylinders forward, causing the beveled blocks to move forward and upward, thus locking the valve slides securely in place.

The spindles carrying the end mills have only a limited vertical movement, and the table *I*, to which the chucking fixture is bolted, is raised by means of the handwheel *J*. Table motion for the profiling work is given by working the handwheels at *K* and *L*, the latter being shown in place in Fig. 1.

In milling these ports, a master is not used to guide the cutter spindles, but stops and distance blocks are depended upon to give the correct sizes to the ports. The stops governing the motion parallel with the table are shown at *M*, *N* and *O*. The long adjuscting screws are *M* and *O*, set into blocks bolted to the table. The stationary block *O* is bolted to the cross-slide.

There are six ports milled in the slides in the case under discussion, so several adjustments are needed to finish them, and the cross-slide stops at *P* and *R* require three different distances to be given. Of these stops, *R* is bolted to the cross-slide and *P* is bolted to a bracket on the knee, the head of the screw butting against the table of the cross-slide as shown.

MILLING PORTS IN BUSHINGS

The machine used to mill the slide-valve ports in brass bushings, differs in a number of details from the one just described.

The inside of the bushing is shaped as shown, by the end at *A*, Fig. 3, and the mandrels on which they are held while being milled, six at a time, are shaped to fit them. Four of the bushings are shown in position at *B*, *C*, *D* and *E*, while two of the empty mandrels are shown at *F* and *G*. The bushings are clamped solidly on the mandrels by the end pieces *H*, *I* and *J*, each one of which clamps two bushings.

These end pieces are slotted so as to be easily lifted up off of the ends of the mandrels, and the bushings may be easily slipped on or off. The ends of the pistons in the air cylinders *K* are set so that when the end pieces are in place and the air is turned on from the valve *L*, the piston ends strike them in the middle and lock the bushings in place.

The methods of operating the table and the stops is practically the same as in the previously described machine, but as the ports milled in the bushings are in three different radial positions, provision must be made to bring these places uppermost in turn. This is done by turning or indexing the mandrels, using locating pins which fit the holes in the pieces *M*.

In order to counterbalance the weight of the table with its fixtures, a lever and weights are used, as shown by the rear view of this machine, in Fig. 4. This halftone also shows the method of belting to the spindles.

Main-valve Bushings

Another multiple-spindle machine for milling cast-iron main-valve bushings for top heads of pumps, from a master form, is shown in Fig. 5.

This is a six-spindle machine, five bushings being profiled at once, the sixth spindle carrying a guide pin for following the outline of the holes in the master.

These bushings, one of which is shown at *A*, have a round, smooth bore, and are held between shouldered pieces, the inside ones *B* being a part of the spindles over which the bushings are slipped, and the outer ones *C* being bearing sleeves set into a long cast-iron bracket *D*, which is set in front and steadies the pieces while being cut. Each outside bearing sleeve *C* is held to the bushing opposite it by a split washer and nut similar to the ones shown on the end of the master bushing at *E*.

Except for slight adjustment, in order to level the cutters, the spindles, like those in the previous example, have no vertical movement, the table being raised to carry the work to the cutters. As the cast-iron cutting is rather heavy work, the handwheels are back-geared to the feed screws, as shown at *F* for the cross feed, and at *G* for the radial feed.

The radial feed, for turning the bushings, while cutting the cross slots, is obtained by having a worm gear on the end of each mandrel, which meshes with a worm on the shaft operated by the handwheel *G*. It will be seen that owing to the shape of the bushings and of the slots cut, no side motion of the table is necessary while cutting, the two feeds described being all that are required.

Another somewhat similar profiler, used for a larger sized bushing, is shown in Fig. 6. This machine has only four spindles, three cutting and one guiding. The operation of the feeds is the same

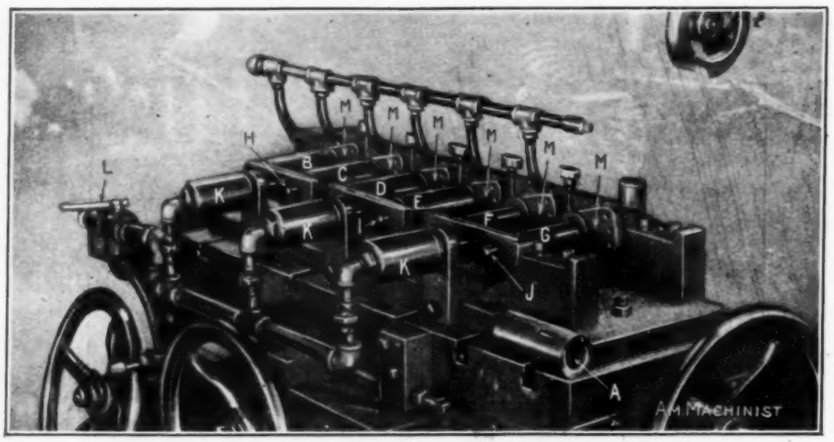


Fig. 3. Milling Slide-valve Ports in Brass Bushing

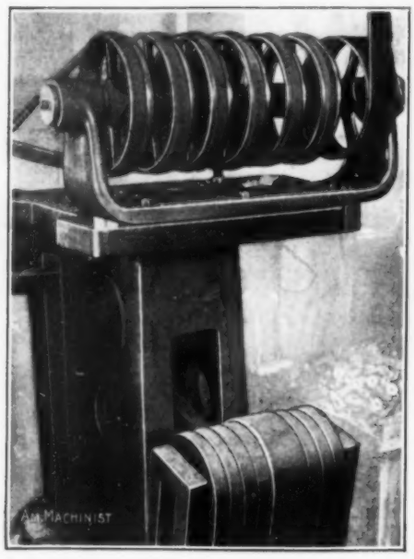


Fig. 4. Rear View of Miller for Slide-valve Ports in Brass Bushings

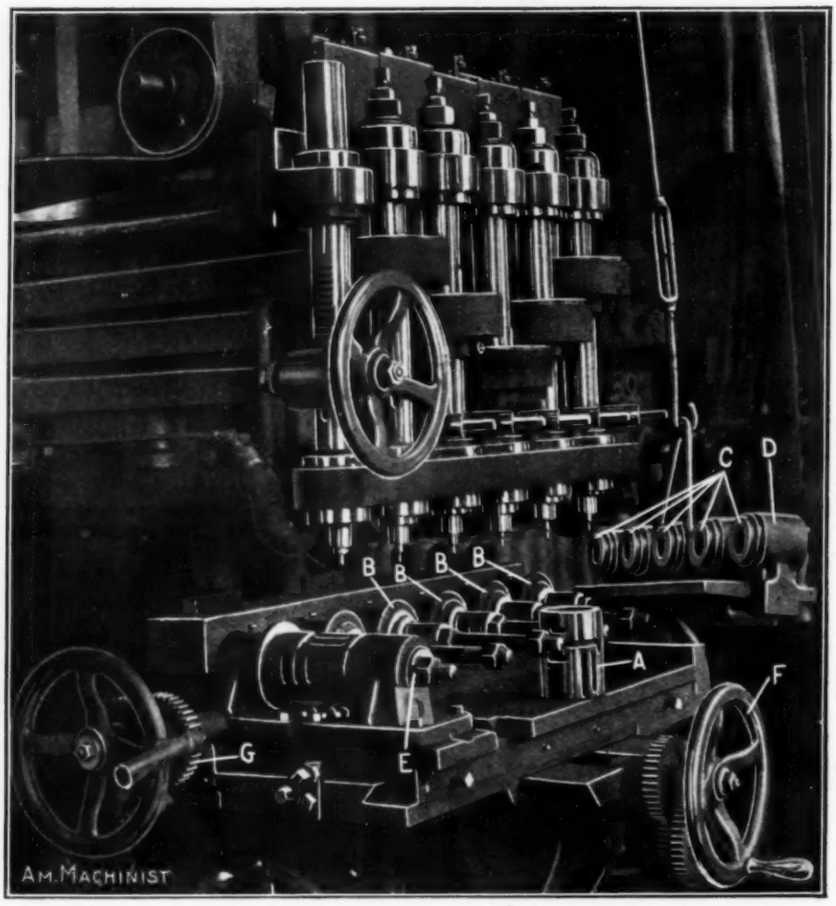


Fig. 5. Profiling Main-valve Bushing for Top Head of 9½-in Pumps

as on the one just described, except that the handwheels are not back-geared. The outer bearing sleeves of the mandrels are held in a bracket similar to the other one, but being lighter, are moved about by means of the two handles *A* and *B*.

End-milling Piston Stems

Some of the stems of brass pistons are milled square, as shown in Fig. 7. The original castings are made almost the shape of the finished pieces, only enough extra metal being put in them to finish nicely. These castings are first turned and centered in screw machines and then placed between centers in the fixtures shown in the halftone, a wedge *A* being slipped between the block *B* and the rough casting; then one side is finished with the end mill. Stops are used to give the correct distance to cut lengthwise, and when one side is finished the wedge is withdrawn and inserted under another side, and so on, until the four sides have been milled.

Turning Pistons

Previous to being milled as just described, the pistons are turned, the first operation being to catch the rough casting by the stem in the shaped false jaws of a screw-machine chuck, as shown in Fig. 8, and rough out the head. Next the head is caught in a split chuck, as shown in Fig. 9, and the stem and back of the head finished.

A number of turret tools is used for this, the first ones turning and centering the end as at *A*, the center hole being used to steady the piece while the roughing and finishing tools are at work, the steady pins or centers on two of the turret tools being shown at *B* and *C*. After leaving this machine, the pistons are chucked by the finished part of the stems and the outside and rim of the head are finished.

Milling the Ends

The radius *A*, Fig. 10, is milled while the piston is held in formed vise jaws, as shown, an end mill of suitable size being used in the spindle and the work fed into it; then the ends are cut to the exact length with a larger end mill, as indicated.

Turning Cock Keys

Brass cock keys are first held in a screw-machine chuck and the large end turned, drilled and tapped; then they are rough and finish turned on the special machine shown in Fig. 11. In this machine, the casting is held by screwing it onto a short stud in the spindle, using a short bar inserted in the opening in the casting to give the necessary leverage.

Two tools are used, a roughing tool at *A* and a finishing tool at *B*. These tools are ground and set so as to work when feeding either way, one casting being turned from the point to the base and the next from the base to the point, and so on, it not being necessary to run the tools back between cuts, as they cut at each traverse.

In working, the roughing tool starts to cut and feeds entirely across the piece

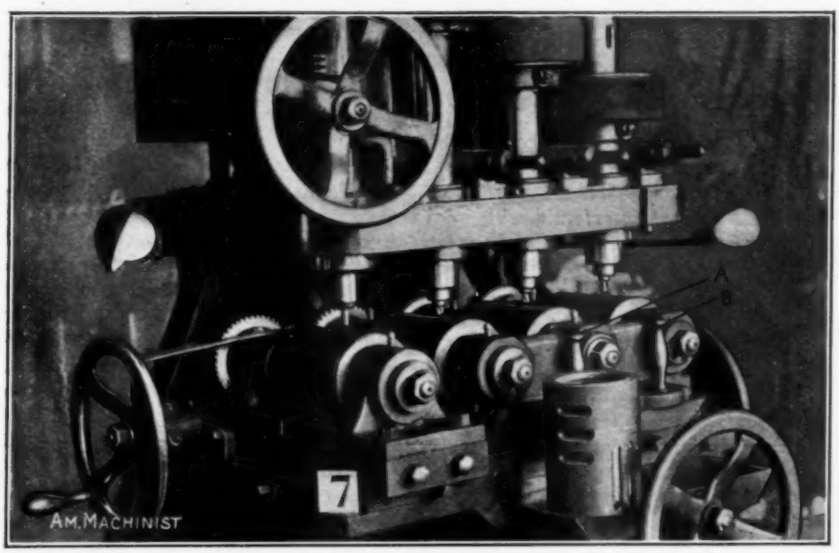


Fig. 6. Profiling Main-valve Bushing for Top Head of 11-in. Pump

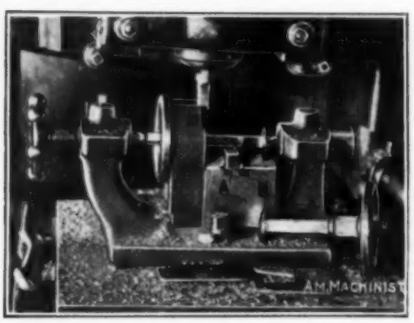


Fig. 7. Profiling Brass Piston Stems

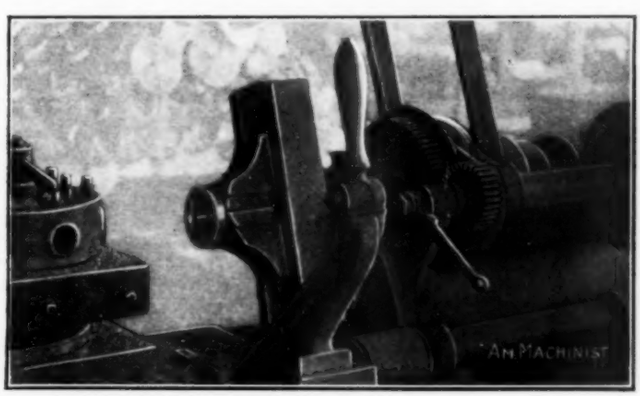


Fig. 8. Roughing Out Piston Heads

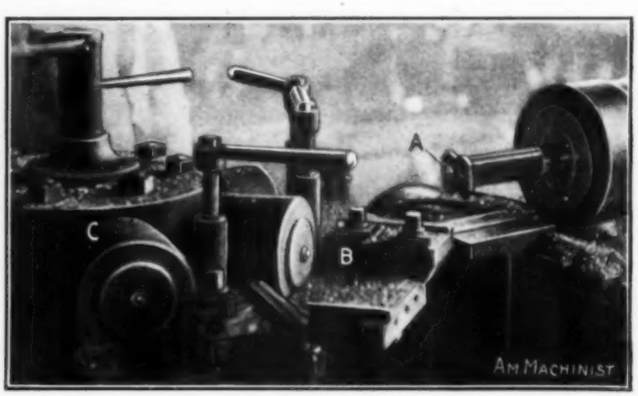


Fig. 9. Turning Piston Stems

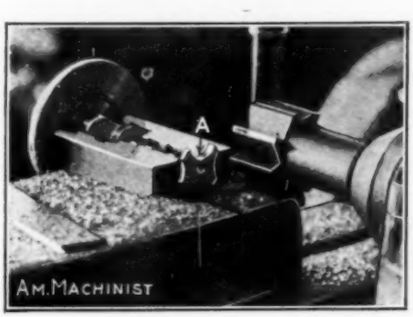


Fig. 10. Milling K-1 Piston to Length

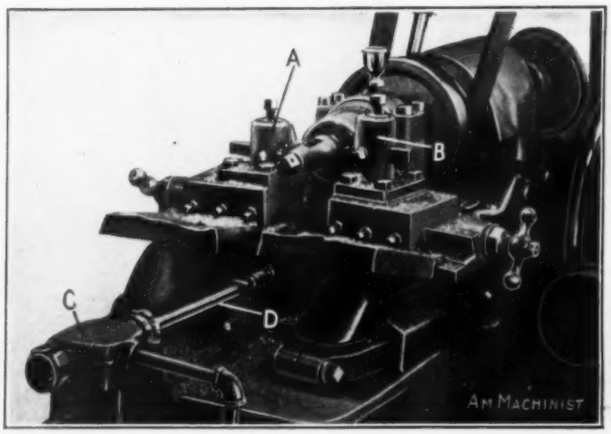


FIG. 11. MACHINE FOR TURNING COCK KEYS

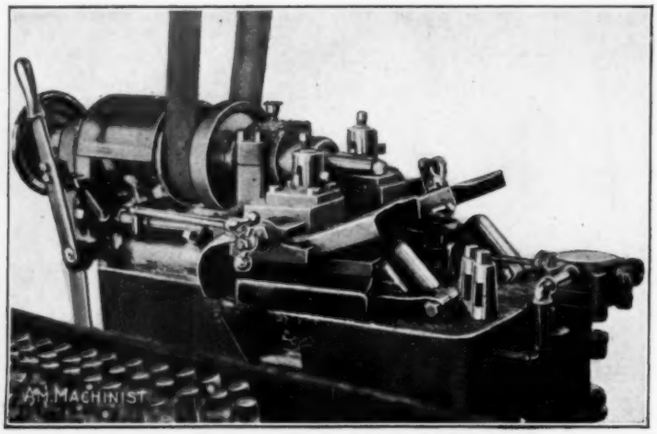


FIG. 12. VIEW OF OPPOSITE SIDE

when it stops and the feed for the finishing tool is thrown in, and this feeds across and stops at the same end as the other one did. The cock key is now removed, another one screwed on and the turning operations are repeated from the opposite direction.

The stops at the ends of the slides are mechanical, but the reversing of the feed screws is done by means of an air-operated clutch in the bed of the machine, worked by means of the air valve *C*. The rod *D*, which throws the valve, extends in between the two tool carriages and is moved by stops set at the proper places. A view of this machine from the opposite side is given in Fig. 12.

BORING OUT COCK BODIES

The bodies into which the keys just described fit, are bored out four at a time in the machine shown in Fig. 13, the bodies being placed in revolving fixtures or chucks, as shown, and the tools fed down at the correct angle to bore the holes the right taper.

In these fixtures, the bodies are placed in about the position shown at *A*, being set against formed stationary blocks as at *B*; then a movable block *C* is laid against the casting, the yoke *D* is pulled over into position and the setscrew tightened. This method of using a swinging yoke makes it possible for the operator to rapidly handle the castings without any of the parts of the fixtures interfering with his movements.

BORING OUT BRASS BUSHINGS

An old screw machine, fitted up with power feed for boring out brass bushings, is shown in Fig. 14.

The rough castings are held as shown at *A*, the chuck used being exceedingly simple and effective, as well as easily operated, and no description is needed, as the halftone plainly shows the construction.

The cored hole in the casting is first roughed out and then finish bored, the turret-feed clutch being thrown in or out by means of the lever *B*. After the boring tool has fed in as far as needed, the reverse is thrown in by means of the rod *C*, which works a lever at the end of the

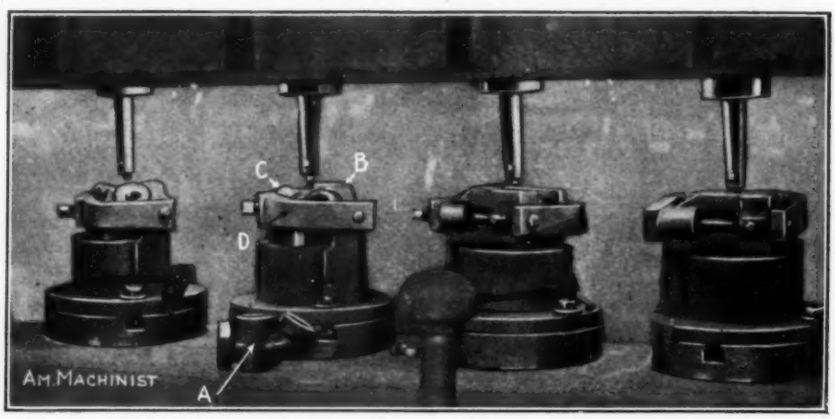


FIG. 13. FOUR-SPINDLE BORING MACHINE FOR COCK BODIES

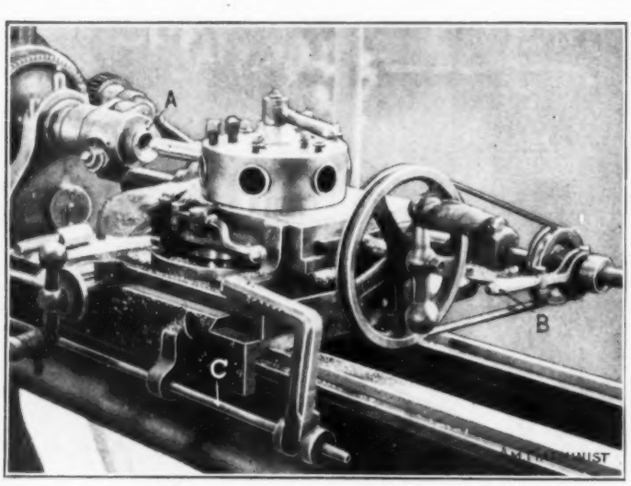


FIG. 14. BORING BRASS BUSHINGS IN AN OLD SCREW MACHINE

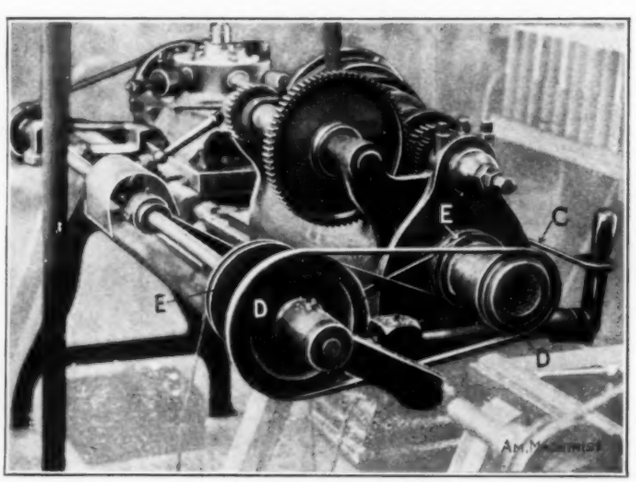


FIG. 15. REAR VIEW, SHOWING FEEDING AND REVERSING PULLEYS

machine, plainly shown in Fig. 15, the turret being run back much faster than it feeds in. The feed and reverse pulleys are shown at *D* and *E*, respectively.

Drilling Valve Slides

Valve slides are held in a box-drilling jig *A*, Fig. 16, while the various holes are being drilled, different depths of holes being obtained by using a stepped block *B* to set the jig on under the spindles. The box jig is shown open at *C*, Fig. 17, the clamping screw at *D* and a number of slide valves are lying on the driller table.

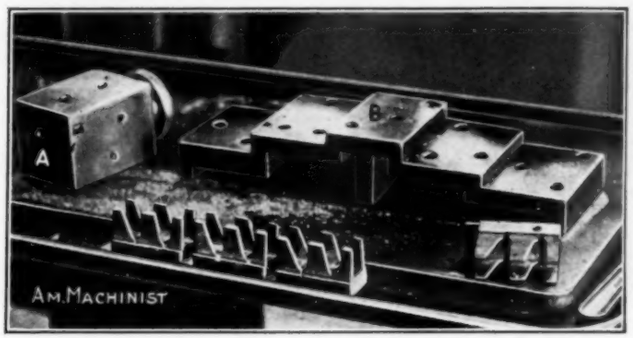


Fig. 16. Drilling Jig and Step Block for Slide Valves

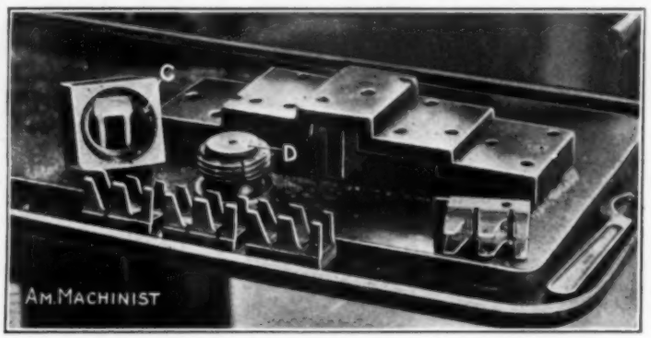


Fig. 17. Drilling Jig Open, Showing Position of Slide Valve

The Difference in Grinding Time and Why

By John R. Godfrey

There are probably few greater chances for misunderstanding than in the time taken for grinding work of almost any kind. One man secures 55 to 60 cylinders a day from his cylinder grinder and the next man has hard work to turn out 10. The last man simply cannot believe that anyone can get out half of what he claims and he has his own private opinion as to the club into which he should be inaugurated. The maker of the machine who advertises the performance is also classed in with the undesirable citizens who regard the truth so highly that they never use it for fear of wearing it out, and he begins to believe that all reports are doctored to sound well.

Both men are doing the best they know how and both are telling the truth as they see it. The first man is using a soft iron which bores easily, so that his holes come true and round from the borer. Then too, he sees that his machine is in good shape,(so that the holes will be straight and that they go on the grinder in the same position. He knows that as a stock-removing proposition the internal grinder is not to be compared with the modern drilling machine. He knows that, with the right wheel in the right machine, the speed of both work and wheel as near right as he can keep them for his conditions, and a good operator, he can get out all that he claims.

The other man uses a harder iron, which makes his boring bars more apt to spring away from the cut; his borer is not adjusted to do accurate work so that the holes do not come straight; he uses too hard a wheel on account of its lasting longer than the one recommended and he is not at all particular about the amount of stock he leaves for the grinder. All these things have a direct bearing on the time and the cost of all kinds of grinding work and especially of cylinders.

The Effect of a Larger Machine

Then too, the machine itself has more effect on the work and the wheel than we are apt to realize. In one particular test that I know of, two machines of the same size were ordered for trial, with the result that *A* made a much better showing for speed and accuracy than *B*. So the *B* people wanted another trial and sent a machine two sizes larger than the first and this time they were pronounced the winners.

Had this machine been tested against an *A* machine of the same size there is no reason to believe that the results would not have been the same as at first. The larger machine has a greater mass of metal to take up the vibration, so that it can use a softer wheel, which cuts more freely than the hard wheel. Then too, the increased rigidity of the machine makes it possible to do more accurate grinding, so that a comparison of this kind is not fair from any point of view.

It is probably because of our ignorance of the underlying principles of the whole grinding proposition that we allow ourselves to be misled in such cases. We do not know any too much about turning or boring, but we have hardly got beyond the kindergarten of the art of grinding.

Grinding vs. Turning

Another instance in which a very essential point was overlooked was in the grinding of automobile axles from the rolled bar. After carefully comparing the time taken to rough turn the axles in the lathe, and to rough grind them in the grinder, it was found that the lathe could reduce the stock more rapidly than the grinder.

It was therefore decided to rough turn the axles on the lathe and finish by grinding, as is usually done. When the total time came to be figured, however, it was seen that it did not agree with the addition of the turning and grinding time, but was considerably more, and, in fact, much more than the total time required to finish them entirely by grinding from the rough.

A little investigation showed that the extra time was required to straighten the axles after turning. The heavy cuts, and the reduction of the entire diameter at once, relieved the internal stresses in the bar, and left it so that considerable straightening was necessary. In fact, this sometimes took from 10 to 20 minutes on each axle.

A little study showed that when these axles were ground from the rough there were very few cases where any straightening was required. In grinding a comparatively small reduction is made at each cut, and as the bar springs from the relieving of the internal tension, it is ground true by the next cut, which leaves it in excellent shape for the finishing grinder.

This simply shows that before deciding on any method of machining work, it is necessary to carefully consider all the conditions which arise, and count the total costs, before deciding which is the better way for the particular job.

Striking results of the strenuous efforts the Pennsylvania R.R. is making to reduce losses from fire on its system are shown in figures from the recent annual report of the insurance department of the railroad. Four hundred and fifty fires that occurred in 1911 on company property valued at $11,500,000 were extinguished by the railroad employees with the company's apparatus.

Packing Lathes for Shipment

By H. M. Wood*

Domestic shipments are made with the lathe mounted on heavy skids and inclosed in an open crate. For long hauls the lathe is partially dismantled.

Lathes for export are completetely boxed to protect them from breakage and to prevent rusting they are even more thoroughly slushed than the machines prepared for domestic shipment.

Use of muslin paper and oiled paper; other details of boxing and crating; weights, cost, etc.

*With the Lodge & Shipley Machine Tool Co.

The problem of packing machine tools to prevent damage in transit is one of vital interest both to manufacturer and user, as breakages are not only expensive, but the resulting delays are often even more costly. The system of the Lodge & Shipley Machine Tool Co. here described illustrates methods of crating and boxing lathes for domestic and foreign shipments, which the large experience of this firm has developed for satisfactorily meeting the rough handling such shipments encounter.

For domestic shipments it is usually sufficient on the shorter hauls to protect all bright parts with a thick coating of heavy grease or slush, mount the lathe just as it stands on heavy skids and build a stout crate all around the outside. An 18-in. cone-head lathe thus prepared is illustrated in Fig. 1. In addition, a waterproof muslin-paper covering is placed over the entire machine. For longer hauls, such as across the continent, it is safer to partially dismantle the smaller lathes. The legs are removed, so that the bed can rest directly on the skids, and the shipper rod is removed from the countershaft.

The requirements that have to be met in packing goods for ocean shipments are particularly exacting. Export cases are subject to the roughest kind of handling and are exposed to the dampness arising from the salt water. Machine tools must be completely boxed so as to protect them against actual breakage, and the different parts must be so held in the box by cross braces that the original accuracy of alignment cannot be impaired by a severe shaking up.

Rough Treatment of Export Shipments

In lifting the smaller boxes by the ship crane preparatory to lowering them into the hold of the vessel, the crane hooks are often dug directly into the sides of the boxes without using a sling chain. If the box has not been strongly built and stiffly braced, the sides will be crushed in by the hooks or at least will be badly damaged. In the case of heavier boxes, one end will be grabbed by the hooks to raise it off the ground for blocking up so that a rope or chain can be passed underneath for slinging the entire box from the crane.

Long boxes, such, for example, as those containing a long lathe bed, must be handled on end in order to get them into the hold. In such a box, if the bed is not entirely fastened in place so that it cannot be slid endwise, it is quite possible that the bed might drop completely through one end of the packing box when the other end was raised. The different parts of the machine must be so braced and secured in position in the box that the box can be tipped completely over or stood on either end without causing any displacement of the contents.

Even more thorough slushing to prevent rusting is necessary than in the case of domestic shipments. Oiled paper is laid over certain of the finished surfaces on top of the slush. No burlap may ever be used around any of the machined parts because of its tendency to absorb dampness. The outside of the box is made of well fitted matched boards to keep out the moisture as far as possible.

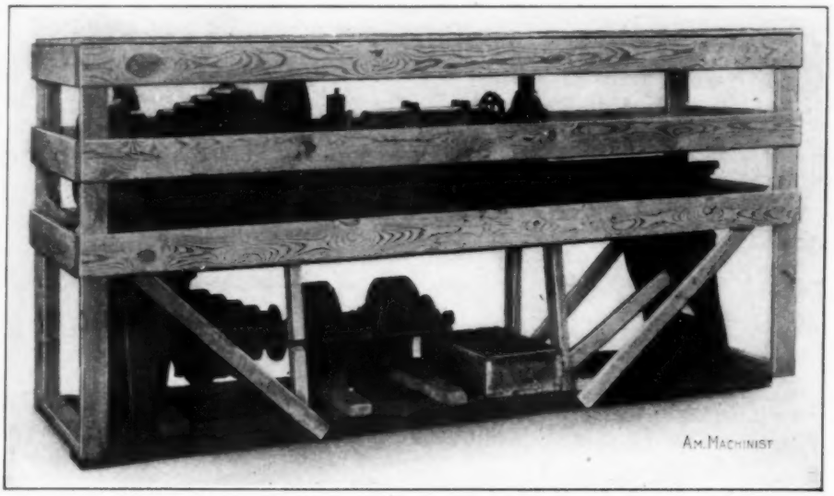


Fig. 1. Cone-head Lathe Crated for Domestic Shipment

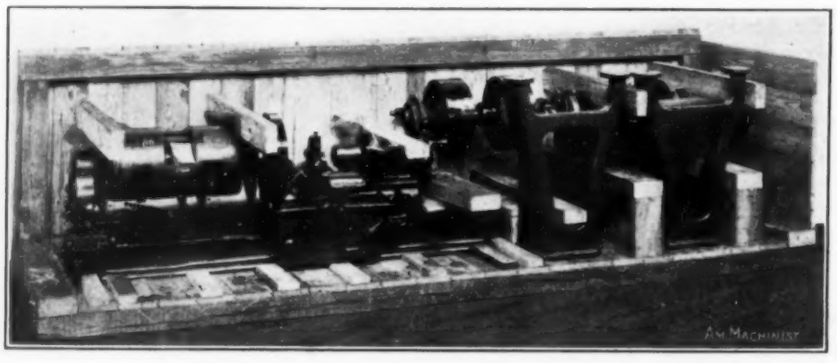


Fig. 2. Front View of "Patent-head" Lathe Partially Boxed for Export

Packing a Small Lathe

Lathes of 20-in. swing and less are packed complete with all accessories, in one case. Fig. 2 is a front view of a "Patent Head" lathe knocked down and partially boxed for export shipment. The countershaft may be seen at the right end of the box toward the rear. The legs have been removed and placed near the right of the box, in front of the bed. The bed rests directly upon the bottom of the box. A rear view of an 1½x8-ft. "Patent Head" lathe partially boxed, is shown in Fig. 3. This machine is also packed in one case with the countershaft, and box of small parts included.

The bottom of the box is laid on two heavy 3x6-in. oak skids running the entire length of the box. The cross braces at the ends are 2½x5-in. oak. The sides, ends, top and bottom of the box are made of 1x6-in. matched pine boards nailed to 2x4-in. timbers, as shown.

All of the bright parts of the lathe are heavily slushed before the machine is placed in the box. Heavy timbers for cross braces, as shown, are placed at frequent intervals through the box to hold the different parts firmly in place and to support the sides of the box stiffly against such end pressure as might tend to crush it. Oiled paper is placed between the cross braces and the lathe at all points of contact.

To further supplement the cross braces for holding the heavy bed securely in place, a wooden block is placed crosswise of the bed on the inside near the center. A heavy bolt is passed from the top of this block vertically down through the bottom of the box. There is a heavy stringer or center skid running nearly the full length of the box and the vertical bolt passes through this stringer also, and is held at the lower side of the stringer by a nut and washer. This guarantees that the bed, which is by far the heaviest part of the machine, will be held securely in the same place no matter in what position the whole box may be set.

After the various parts of the lathe have been placed in the box and secured by cross braces as shown in Figs. 2 and 3, the other end and sides are nailed on. The whole box is then bound with iron bands, as shown in Fig. 4. This forms a very substantial case and one which well withstands the rough handling and exposure to which export shipments are almost always subjected.

Boxing a Large Lathe

It is not practicable to pack a large lathe with all parts and accessories in one case. Sizes from 22 to 30 in., inclusive, are packed in two boxes, one box containing the bed and small parts, the other box containing the remainder of the machine. Fig. 5 shows the method of packing a 2x10-ft. bed, with the box of small parts placed directly on top of the bed. The packing case itself is built up in a manner similar to that just described in the case of a small lathe, except that heavier lumber is used. Fig. 6 shows the manner in which other parts of this same 24-in. lathe are secured in a second box. As will be seen from the illustration, these parts comprise the headstock, carriage, apron, tailstock, legs and countershaft.

Three boxes are used for packing 36-in. and larger lathes. One box contains the bed only. The countershaft, small parts and different assembled units of the lathe are distributed between the other two boxes as best suits the individual conditions.

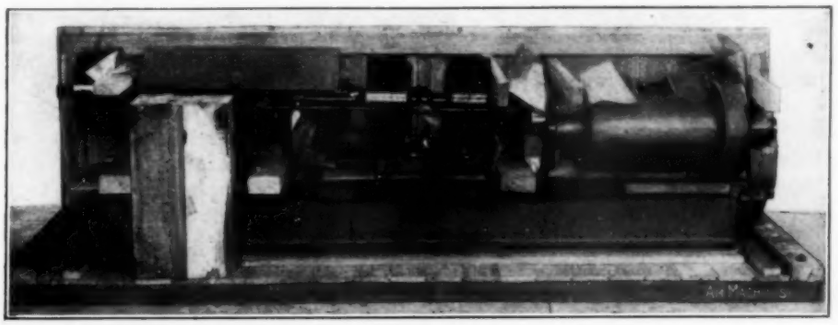


Fig. 3. Rear View of "Patent-head" Lathe Partially Boxed

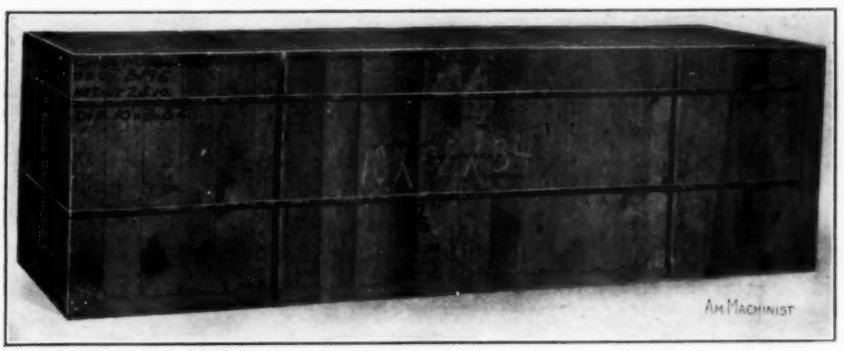


Fig. 4. Outside of Packing Box Containing a Small Lathe Complete

Cost and Weight of Boxing

The cost of complete boxing of a lathe for export as described is between 2 and 4 per cent. of the full value of the finished machine. The proportionate cost, of course, varies with the style of the lathe and the size.

The increase in weight of the shipment due to boxing will amount to from 10 to 40 per cent. of the net weight of the finished lathe. In the case of small 14-in. lathes, the boxing will weigh approximately 33 to 40 per cent. of the net weight of the lathe itself. As the size of the lathe increases, the relative weight of the box to the lathe decreases. In the case of large 48-in. lathes the boxing weighs between 10 and 12 per cent. of the net weight of the lathe. If a lathe is unusually long, so that the bed is made in two sections, it is necessary to box the lead screw separately, and in such special cases the weight of the box used for the lead screw is about three times the weight of the screw.

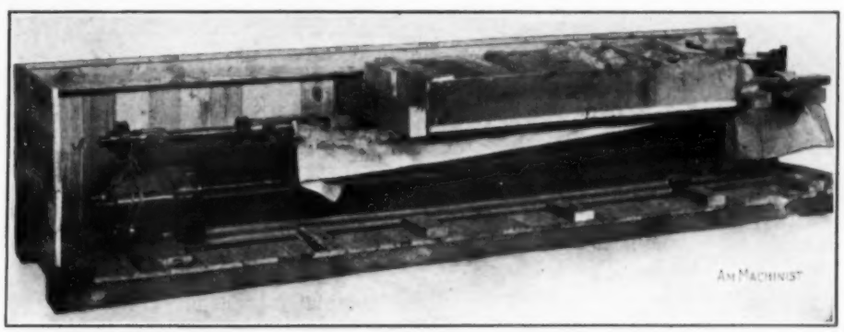


Fig. 5. Bed and Box of Small Parts for "Patent-head" Lathe

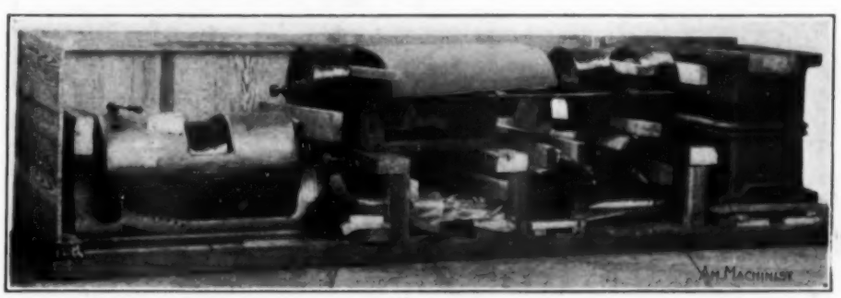


Fig. 6. Other Parts of 2x10-ft. "Patent-head" Lathe Packed Separately

Management in the Drafting Room

By J. A. Furer*

An outline of systematized management in a large drafting room. The draftsmen are divided into three sections, planners, detailers and tracers, with a chief draftsman in charge.

Each chief knows at all times exactly what work is ahead of his section as a whole, what is ahead of each draftsman and what is in progress. The example is the drafting room of a United States navy yard.

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That the drafting room is susceptible of systematized management resulting in increased efficiency by methods analogous to those employed in the shops has been fully demonstrated in the hull division of the Philadelphia Navy Yard. The system described below has now been in operation over a year, and has fully established its worth.

At the outset it may be well to describe briefly the general character of the work which a navy-yard drafting room is called on to do. The productive work at a yard not engaged in new construction is of a jobbing character, and the drafting room work, therefore, also partakes of that nature. It may, however, be classified under the following three, more or less, well defined headings:

New Design: Consisting principally of inventing and developing new appliances and fittings for installation on ships to improve their fighting efficiency. At a navy yard where new construction is not a large part of the work, this class of drafting is more limited than at a shipbuilding yard.

Alterations on old ships to bring them abreast of more recent construction: This class of work involves new design to a considerable extent, but consists principally in adapting the latest standard practice worked out for new ships to the special conditions existing on the older ships.

Making finished plans of ships for reference and record purpose: On account of the alterations which are continually being made in ships to increase their efficiency, the general reference plans must constantly be revised to keep them in agreement with the ships. The amount of work necessary to keep such plans up-to-date is surprisingly large. For example, the "Idaho" and "Mississippi," which were commissioned in 1908, have been altered to such an extent since that date that practically all the general plans will have to be retraced at the present time.

The drafting-room work necessary in making alterations on ships is the largest part of the work done in the hull division of the Philadelphia Navy Yard. The magnitude of the individual job varies from the almost daily requests for minor alterations from ships in commission (some of which can be shown on sketch plans occupying only a few hours of the draftsman's time) to a general redesign of a ship out of commission, involving many months of work for a large part of the drafting-room force.

Organization

The drafting room, as one of the branches of the nonproductive force, comes directly under the inside superintendent. The functions of this superintendent are to supervise the preparation of all plans, estimates and correspondence relative to the performance of work, and to issue the necessary job orders, instructions and plans to the outside and shop superintendents for the execution of the orders. The relation of the inside superintendent to the drafting room is very similar to that of the engineer of an industrial plant to its drafting room. The draftsmen are divided into three sections, planners, detailers and tracers, with a chief draftsman in charge.

Planning Section

Maximum efficiency in an organization is possible only when every member of the organization is occupied on work which taxes his faculties to the exact limit of his capabilities at all times. Practically every original plan, no matter how minor in character, requires some high-grade mental effort, either a call on past experience or actual creative work. On the other hand, however, a large part of the work on all plans is purely manual and reproductive, rather than creative; therefore no establishment can afford to employ any but high-grade draftsmen.

In order to have the broad outlines of design planned by draftsmen of extensive experience and adequate mental equipment meet the more difficult features of each problem, a planning section has been established in the drafting room. This section consists of a number of the high-grade draftsmen with wide experience in all classes of ship work.

When a job comes up for consideration, brief instructions are dictated by the inside superintendent, which are typewritten on 4x6-in. cards, as shown in Fig. 1. This card and a carbon copy are sent to the chief draftsman, who assigns the job to one of the planners for the preliminary work. The card is not intended to give complete instructions as to how to do the job, but is used principally as a job order card in connection with the routing and assignment of work.

NAME	ISSUED	STARTED	COMPLETED
JOB			
REMARKS			
ACTUAL TIME ON JOB IN HOURS			

FIG. 1. PLAN ORDER CARD

If the plan required covers an alteration on a ship at the navy yard, the inside superintendent investigates the job with the planner to whom the preliminary assignment has been given by the chief draftsman. Such investigation is usually made on board the vessel, as there are always local conditions which govern many features of the design. After the general features of the design have been settled by the inside superintendent, the planner prepares written instructions for the job, and frequently makes free-hand sketches to point the draftsman to whom the job is finally assigned for detailing.

Some times, of course, the job is of such a character that it would be a waste

of time for the planner to go into the job in very much detail. To make the work of the planning section really productive of increased efficiency requires judgment and intelligence. As specific examples are always more illuminating than generalities, the following job is given as typical of the kind of work done by the planning section:

A request was received from one of the ships to install heavier doors to replace certain doors leading to the superstructure. The desirability of making the alteration was apparent; and the job, for its proper execution in the shops and by the outside force, required a plan. The following instructions were prepared by the planner:

WATERTIGHT DOORS IN SUPERSTRUCTURE

The standard watertight door in accordance with general type plan 21 is not practicable for this installation because extensive alterations in the bulkhead fittings, etc., would have to be made in order to install the dogs as called for by this type plan. Adapt the former standard, Sheet 3, for this job. Make an elevation of the door, which need not be to scale, on which enter over-all dimensions of the doors, as the doors cannot all be made of the same width. Retrace the dogs and fittings from the old blueprint on hand, as the negative is too indistinct for making further prints. Patterns are probably on hand for all of the fittings. Investigate and enter the numbers in the material schedule. Consult New York and Norfolk die books for drop forgings which can be used on the job. Enter the die numbers in the material schedule.

The execution of this job, after it had been planned, was turned over to a comparatively inexperienced and low-priced draftsman who, with the instructions before him, was enabled to start the plan promptly and to carry it to completion with a minimum loss of time. The planner, with his extensive past experience to draw upon, was able to prepare these instructions in a few minutes. If the job had been turned over to the detailer without such instructions, it would have taken him several hours to arrive at the same point which the planner reached in a few minutes.

Formerly the chief draftsman attempted to furnish such instructions to the draftsmen, with the result that his time was so fully occupied that he could not attend to his other more important duties, and the instructions were also slighted, consequently the draftsman had to shift for himself. One of the principal objects accomplished in having the preliminary instructions prepared by the planning section is that there is always a number of jobs planned ahead for each detailer, so that no loss of time is incurred by the draftsmen in waiting for new assignments.

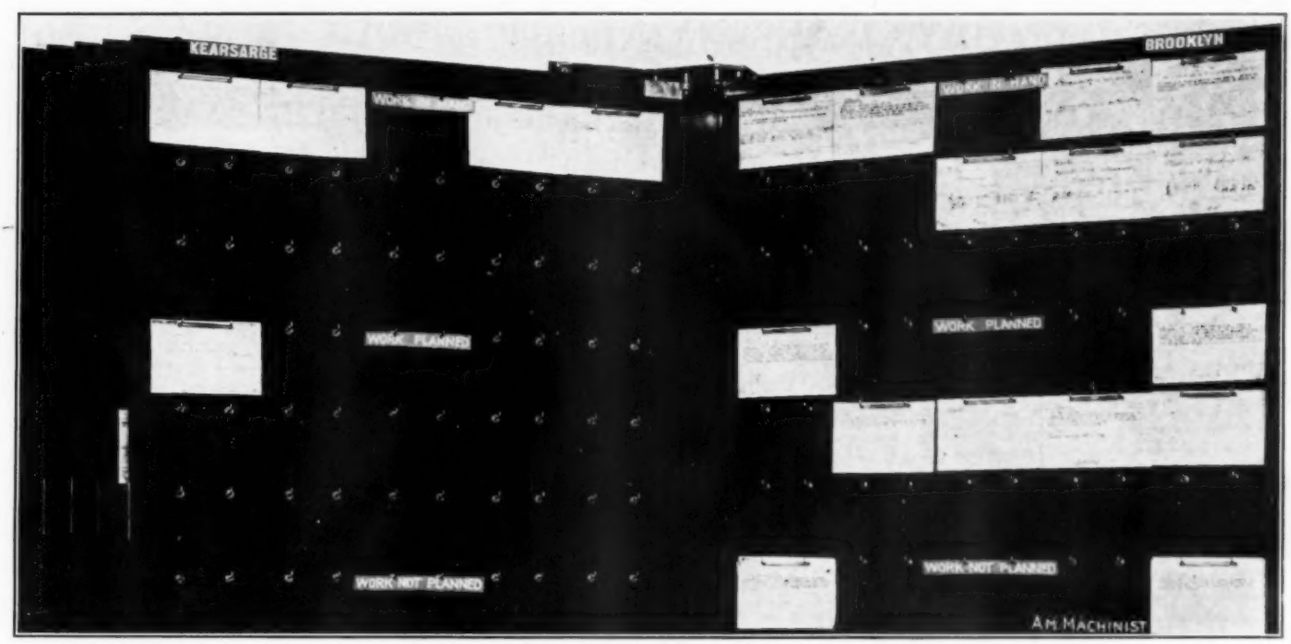


FIG. 2. PLAN ORDER FILE BOARDS

DETAILERS

After a job has been planned, it is assigned to a detailer for execution. Every effort should be made to specialize the work of the detailer. Where a large variety of work must be done with a limited number of men it is, of course, impossible to adhere rigidly to this principle, and in the interests of the draftsman himself it is well that he should not be kept too strictly on one line of work. One of the most prolific sources of waste in a drafting room is the lack of definite ideals in making plans, and the striving after false ideals on the part of the detailer.

In making a plan, the draftsman should attempt to attain three objects: To convey correct information, to convey adequate information, and to convey the information so clearly that the person who uses the plan will be able to assimilate quickly the information which it is intended to convey. A plan that is perfect in these three respects is a perfect plan.

Every line on a plan which does not contribute to accuracy, clearness and adequacy is worse than wasted, even if it apparently improves the appearance of the plan. The ability of a draftsman to restrict his work on a plan to the attainment of these ideals is a large measure of his efficiency. One of the most important duties of the chief draftsman is to see that these ideals are attained as nearly as possible.

FINISHED PLAN SECTION

A set of plans for general reference is made of every ship. These plans represent the finished ship; that is, they are the general assembly plans of the vessel. Most of these are not working plans, as details of construction are not shown thereon. On acount of the constant alterations made on vessels of the navy, these plans must frequently be revised to keep them up to date. This class of work requires little technical knowledge, as it consists principally in collaborating data from the working plans. Frequently, also, the data must be taken directly from the ship in order to show the actual existing conditions. These plans are made by the finished-plan section.

Newly appointed draftsmen of the lower ratings are always placed in this section for their apprenticeship. Many of the recruits are draftsmen who have had no experience in any kind of drafting work. The experience gained in the finished-plans section familiarizes them with the general features of ship con-

struction, and also gives them excellent training in making neat and rapid tracings.

A medium-priced draftsman is in charge of this section, and acts in the capacity of a squad boss. His duties are those of an instructor as well as those of a checker, to see that the data are correct. When these junior draftsmen become proficient and have acquired a good general acquaintance with ship construction, they are graduated to the detailing section.

Assignment of Work

The chief draftsman should at all times have clearly before him exactly what work is ahead in the drafting room as a whole, what work is ahead of each draftsman, and what work is actually in progress. Without this information readily accessible and absolutely up to date, it is impossible to give the proper precedence to the drafting-room jobs. It is of the greatest importance, in shipbuilding especially, to give very careful consideration to the procedure of work in the drafting room so that the plans may be timed to fit in with the outside work.

The apparatus used to accomplish these objects consists of the "Plan Order Card," Fig. 1, the "Plan Order File Boards," Fig. 2, and the "Work Assignment Boards, Fig. 3.

The "Plan Order File Boards" are 32x48 in., and are hinged against the wall so as to save space, as shown in Fig. 2. Commercial wall board, ¾ in. thick around which a white pine frame is fitted, is found the most suitable material for making these boards, as it is cheap, very light, and does not warp. There are 12 of these boards; the whole side of a board being reserved for each ship domiciled at the yard.

The "Work Assignment Board," Fig. 3, carries the name of every draftsman in the force. Under the name of each there are two pairs of hooks for hanging the plan orders; the lower pair for the jobs ahead of the draftsman and the upper pair for the one job on which the draftsman is actually engaged.

A plan-order card is made out in duplicate for every drafting-room job, irrespective of the time required in the execution of such. As soon as the chief draftsman receives such an order for work, he hangs the carbon copy on the work-assignment board on the lower pair of hooks under the name of one of the planners. The original is hung on any pair of vacant hooks on the plan-order file board of the ship concerned under the marker "Work Not Planned."

The "Plan Order File Boards" are divided into three groups of hooks by portable markers; the upper group representing plans in progress, the middle group drawings which have been planned but which have not been started, and the lower group drawings which have not yet been planned. These boards carry, therefore, a complete record of all work in the drafting room.

By hanging the orders for work on these boards instead of filing them in books, the status of the drafting-room work as a whole can be quickly ascertained, and by segregating the orders by ships, the status of the plans required for any ship can be sized up at a glance.

When a planner starts investigating a job, the card on the assignment board is shifted from the lower pair of hooks under his name to the upper pair. When the preliminary planning has been completed, the card is transferred from the planner's hooks to the lower pair of hooks of the draftsman to whom the detailing of the plan is assigned by the chief draftsman. The corresponding card on the file board is shifted at the same time to any pair of vacant hooks in the group of "Work Planned" jobs.

When the plan is started by the detailer, the card on the lower pair of hooks is moved to the upper pair under his name. The corresponding original on the file board is also transferred from the "Work Planned" group to the "Work in Hand" group, thus keeping the file board in step with the assignment board.

Time Record

Wastes of time on the part of the draftsman in the execution of a plan may be due to incompetence, carelessness, indifference, or chronic laziness. Systematic soldiering is not so great a factor in keeping down the output of the drafting room as it is in the shops, because the incentive for the mechanic to deliberately keep his output as low as possible is greater than it is for the draftsman. These wastes of time can be materially reduced by keeping a record of the time spent by the draftsman on each plan.

As soon as a plan is begun, the draftsman enters the time and date of starting on the plan-order card which hangs on the file board. If he is taken off the job temporarily, he makes a notation of the off and on time on the card, and finally enters the date of completion thereon. These cards are filed away for future reference, and are of considerable value to the management in selecting men for promotion and in correcting abuses. The

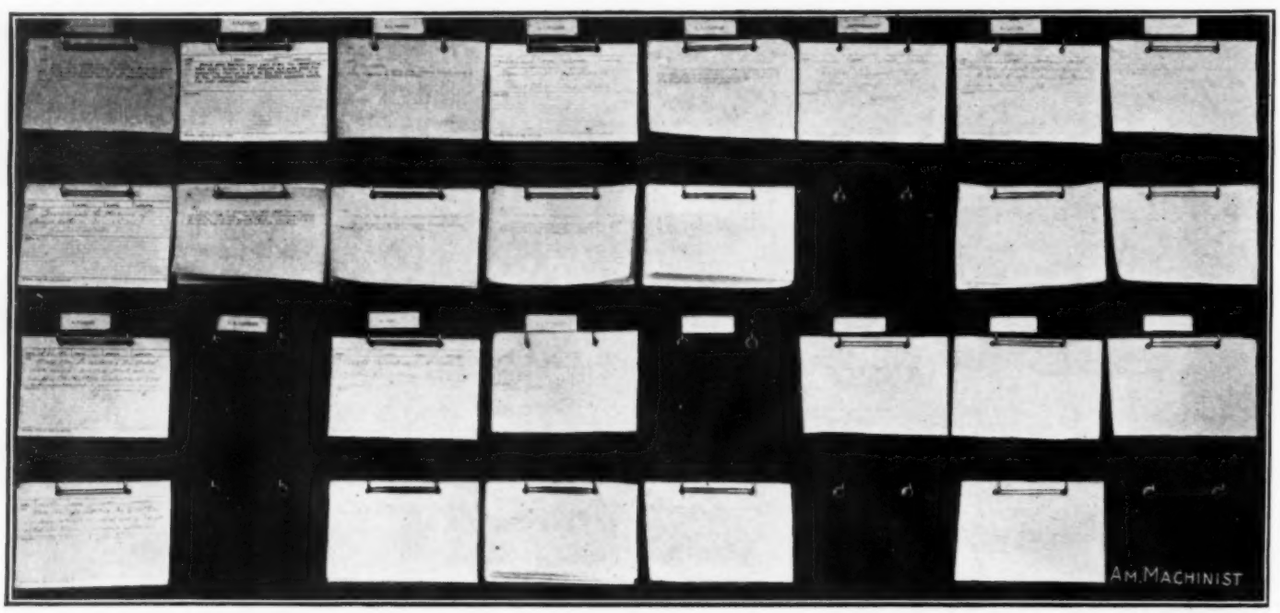


Fig. 3. Section of Work-assignment Board

number of hours spent on the plan is also entered in an inconspicuous place on the plan, so that the plan itself carries the record of its cost.

Inspection of Finished Work

A mistake on a plan is of little consequence until after the plan has left the drafting room. Once the blueprints have gone out, however, a mistake, even if of minor character, may cause endless confusion and expense before it can be corrected. In the long run, therefore, it will be found economical to spend some extra time and money on checking every plan before it is finally passed as complete. The checking is done by the planner who prepared the instructions for the job.

This procedure may appear to violate the principle that inspection and production should be entirely separate functions, if absolutely disinterested inspection is to be obtained. The objection does not, however, really hold good in this case, because the planner is not responsible for the details of the plan; and it is in the details that errors most frequently occur. The system has the great advantage that the checker already knows the object of the design and the requirements to be met without having to spend time in familiarizing himself therewith.

Consulation of Foremen

Draftsmen should be given every opportunity to acquaint themselves with the mechanical processes involved in doing the work called for by the plans on which they are engaged. It should also be made as easy as possible for them to obtain practical advice.

The usual attitude of the mechanic is that the draftsman is a fellow who wears good clothes and keeps his hands clean, but who cannot possibly have any idea as to the best way of doing a job in the shop. The draftsman reciprocates this feeling in the attitude that the mechanic has no originality, but is purely a rule-of-thumb creature.

Nothing delights the heart of a foreman so much as to criticize a plan on the grounds that the construction proposed is impractical from the point of view of the mechanical processes involved. The more wide-awake he is, the more apt he is to bring this critisicm to bear on plans. This feeling of hostility between the draftsman and the practical man is not entirely objectionable, as a reasonable amount of friction in this respect is healthy, because it stimulates the one to exercise every precaution to avoid unnecessarily expensive construction, and the other to scrutinize plans carefully.

If this feeling of rivalry can be harnessed, it can be made productive of much good. The system employed to accomplish this result is to require the draftsman, during the progress of the design, to consult frequently with the foremen as to the various details of construction of the job. Such consultation is effected with very little loss of time on the part of either the draftsmen or the foremen, because all foremen visit the main office daily anyway to attend a ten o'clock conference, for the purpose of coördinating the outside work.

A draftsman desiring consultation hands a request slip to the inside superintendent before the meeting, and the foremen concerned are then directed to see these draftsmen, after the meeting. The difficulty lies in making the draftsmen realize the value of such consultation during the progress of the design, the tendency always being to wait until the plan is completed, which often results in the necessity for considerably more revision than would have been the case if advice had been asked during the early stages of the design.

Center Lines of Eccentrics

By Walter Holl

To get the center line of an eccentric may be an easy matter in itself, but it is fraught with many difficulties when the problem is submitted to the uninitiated for solution. This is especially true under prevailing condition, where machinery parts are finished in jigs, fixtures or chucking lathes, and the end centers are gone.

As each man on the job is sure to have a different method of accomplishing the same result, the following methods are given to help those who may not be familiar with this work.

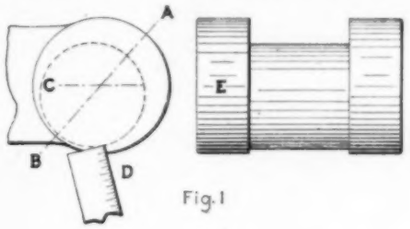


Fig. 1

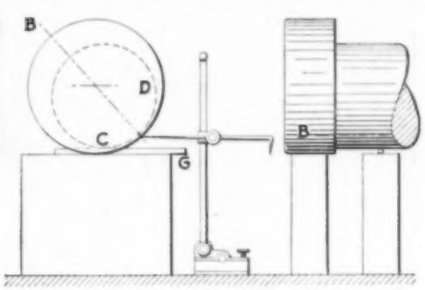


Fig. 2

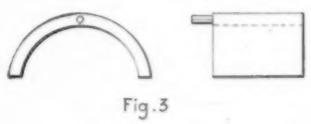


Fig. 3

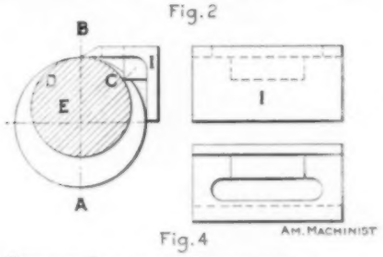


Fig. 4

Am. Machinist

Methods Employed to Find Center Lines of Eccentrics

The first case in point was a lot of eccentrics turned in a lathe by means of a cam-motion fixture which left no eccentric center on the end of the part machined. It, therefore, became necessary for the fitter to have a center line *AB*, Fig. 1, across the end of the eccentric in order to set it plumb; following the lines of least resistance he placed the end of a scale on the eccentric, moved it around close to the shoulder of the flange *E* in the direction of the point *C* until it split the ⅛-in. line and marked that point with the scratch awl and center punch. Repeating the operation in the direction of the point *D*, he then, with a pair of dividers, gets the center of these two points, which he believes to be the center of the eccentric.

The next man on the job used a different means of securing the same result.

By taking three parallel blocks, Fig. 2, placing one at each end and one in the middle under the eccentric and rolling the eccentric until the point *C* touched a piece of ⅛-in. wire placed on top of the middle block, he scratched, with a surface gage, a line on the eccentric at *B*. Reversing the eccentric and repeating the operation at the point *D*, the point half way between the two scratch lines (in case they did not meet) was the center of the eccentric in his estimation.

The method of the next man as illustrated in Fig. 3 was simple, but it requires very good light and eyesight, and a sensitive touch.

He bored out a cast-iron bushing to the same size as the eccentric, cut it in half and fitted a pin in the center as close to the inner edge as possible. With both sides of the pin filed down to a central edge he placed the semicircular bushing on the eccentric, and scratched a line from the edge of the pin at the point *B*, Fig. 2. This finds the center of the eccentric but it requires a new bushing for each different size eccentric.

The next man tackled the job in the way shown in Fig. 4, which by this time should be self-explanatory as the elementary points have already been dwelt on. This method has much to recommend it and should prove the most convenient and rapid when the eccentrics are all of uniform size, or have projecting arms that would interfere with easy manipulation on parallels or V-blocks.

Methods in 'Frisco Railroad Shops

Editorial Correspondence

Important features of one of the newest and largest of the western railroad shops, including ways and means of planing cylinders, shoes and wedges, driving box brasses, etc., boring and facing brasses, turning and rolling driving axle journals.

Appliances for lifting driving wheels into the lathe and for handling tires without interfering with the boring-mill heads. A turning rig for tumbling shaft bearings.

In the new Frisco shops at Springfield, Mo., there are many interesting special tools and methods well worthy of illustration. Some of these features are here illustrated and others will be represented in a later article.

In order to give a general idea of the character of the shops themselves, two views are presented in Figs. 1 and 2, showing interior constructional features and the arrangement of the machine equipment and cross pits for locomotives.

A large planer is seen in the foreground of Fig. 1 with a radius planing attachment for cylinder work. A better view of this Putnam planer and the method of performing the operation is shown in Fig. 3.

Operation of the Planer Head

The planer tool is carried at the end of a heavy holder and is adjusted to the desired radius as measured from the center of the swivel on the head. The saddle carrying this head is clamped to the crossrail at the proper point in relation to the cylinder casting, the swivel bolts are eased enough to allow the head to swing, and the upper end of the slide is connected by a rod to the left-hand planer head. When the feed is applied to traverse the latter along the crossrail, the right-hand head is swung about its swivel and the top of the casting is thus planed out to the required arc.

Another planing operation is shown in Fig. 4 which represents the method of machining shoes and wedges, several at a time, under each planer head.

Boring and Facing Driving Boxes

A self-centering chuck for carrying driving boxes while they are being bored and faced upon a Bullard 36-in. vertical mill is shown in Fig. 5.

The jaws of this chuck are operated in unison by a right-and-left hand screw to close them upon the sides of the box, which rests upon supports on the face of the chuck body. As the chuck itself is located centrally with the table the work is thus centered laterally by the mere closing of the jaws. At the same time the holding-down effect upon the driving box is secured by means of clamps pivoted in the jaws and actuated by jack-screws at the outer ends as indicated in the photograph.

The ease with which the boxes are put into place and centered permits the work to be carried along rapidly, and an average time of 20 minutes is readily maintained for the operations of boring the brass and facing the lateral bearing.

Planing Fixture for Driving Box Brasses

The halftone, Fig. 6, shows a fixture for holding brasses while machining the edges on either a planer or shaper. In this case the fixture is in use on a Cincinnati traverse-head shaper.

The fixture consists of a channeled casting whose two ribs form a seat for the back of the brass which is clamped in place by a setscrew at each end. A cut 1 in. in depth by $\frac{1}{32}$ in. feed can be taken with the work held in this manner, and the planing operation requires not over eight minutes.

Fig. 1. The 'Frisco Shops, at Springfield, Missouri

Wheel Lathe Tools

In Fig. 7 tools are shown for use in the wheel lathe for turning and rolling journals and facing wheel hubs. The turning and facing tool at the left consists of a cylindrical body with a slotted head for the cutting tool, the round body or shank being secured in a split holder made up of a block with semicircular seat and a cap with similar interior.

Clamp bolts hold the tool securely in place and the whole block is clamped to the regular tool slide.

The roller finishing tool is shown in the holder at the right. The hardened roller itself is about 4 in. in diameter with ½-in. face and gives an excellent finish to the journals, a few thousandths only being left for the rolling process after the turning tool has completed its share of the work.

Handling Wheels and Tires

Two handy appliances for lifting wheels and tires are illustrated in Figs. 8 and 9. The first of these, a bar with loop and eye-bolt for the crane hook, is represented as used in lifting driving wheels in and out of the large-wheel lathe. The device in Fig. 9 is used in lifting locomotive tires on and off the borer table and enables the operator to place the tire on the machine table without striking the machine heads as would be the case if it were lifted simply by chains.

The supporting bar is secured to the edge of the tire by a taper wedge driven in between the outer surface of the tire and the bent end of the bar. By driving out this key the tire is released at once.

Fig. 2. 'Frisco Shops, at Springfield, Missouri

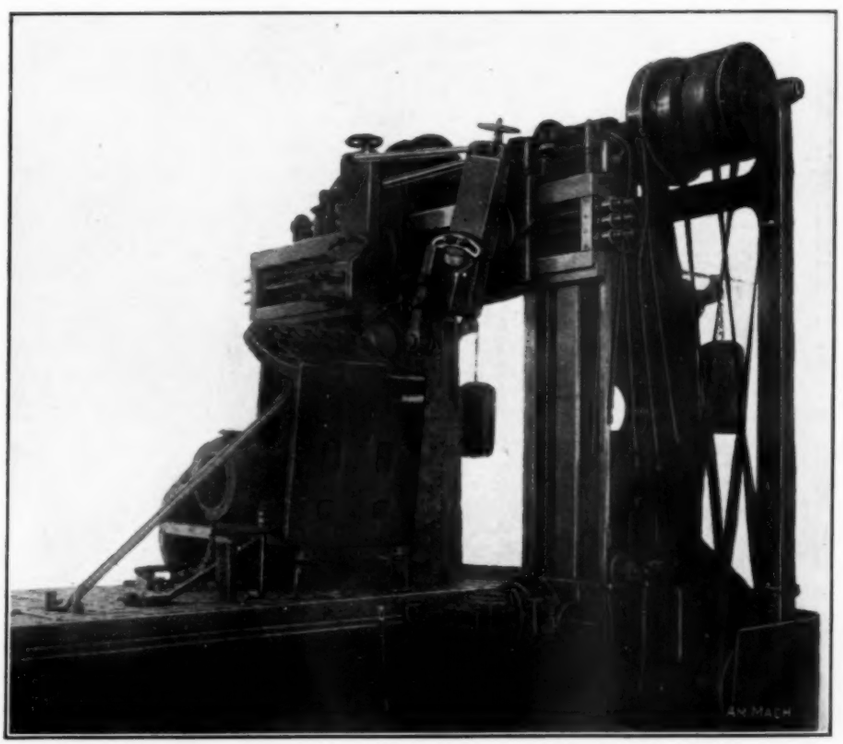


Fig. 3. Radius Planing Attachment for a Locomotive Cylinder

Turning Tumbling Shaft Journals

The final illustration, Fig. 10, shows a method of turning the bearings of tumbling shafts. The work is fixed between centers and the turning operation is accomplished by means of a hollow mill which is rotated by a sleeve connection on the spindle nose. The hollow mill is fed along the work by means of a forked bar which fits at one end in the tool post of the lathe, while the other engages in a circumferential groove with which the hollow mill is provided.

The method of holding the cutter in the hollow mill and the means of adjustment to enable it to cut to the desired size will be seen upon inspection of the engraving.

This lathe, like several others in the hop, is provided with a light jib crane which enables the operator to swing a heavy chuck onto the spindle, or to remove it with little effort. When the chuck is out of use it hangs suspended from the crane until again required.

Teaching By Suggestion

By C. A. Tupper

In the popular literature of the day we hear a great deal of the power of "suggestion," which is ordinarily associated in our minds with various psychic phenomena, including hypnotism. Seldom, however, do we stop to realize that in its plainest, most matter-of-fact significance, this term has a meaning intimately associated with successful management in every line of work.

For metal-working plants, where individual skill and experience are essential factors, the practical application of this idea is particularly valuable. In most cases it is unconsciously applied, as a result of natural qualities of leadership on the part of foremen, superintendents or other executives; but more recently it has come to be, for at least a number of large establishments, a well recognized and deliberate matter of policy. Its underlying principle is the development of individual initiative and the encouragement of team work.

The best example known to me of what may be termed the unstudied application of the idea came under my observation, when a boy, in the old Reliance Works at Milwaukee. There I was accustomed to see E. P. Allis moving about among the men at the machines, observing their work, taking mental note of their ideas and suggestions and making pertinent comments—bestowing here a mild criticism, there a bit of praise or, in probably the majority of instances, merely a friendly word. It was a noteworthy example of natural leadership in an industrial pursuit and, being emulated by all others in responsible positions, resulted in a degree of efficiency which made the Reliance Works known the world over.

Changing times have brought different conditions. Personally, I fail to see why shop superintendents, at least, cannot keep as closely in touch with their best men now as they did 20 or 30 years ago. Most plants are not so large that it is impossible for all of the operating heads to know the elements of the work under their control. There are decided advantages in having all departments of a business so organized that the supervision exercised by any individual is only one factor in the general scheme of operations; and with large companies this becomes a practical necessity.

Developing Action Through Suggestion

In either case the deliberate fostering of a policy of "suggestion" can be made a vital influence in the success of the business. By "suggestion" I do not refer merely to the restricted sense in which that word is used when spoken of in everyday affairs, but also to the larger meaning of getting men to think for themselves, to translate their thoughts into action and to bring about certain desired results.

For example, on a certain occasion the vice-president and general manager of a large machine-building corporation, who had been "on the job" only a short time, made a note on his pad to talk to the works superintendent about dissensions then existing between the machine shops and the foundry over the delivery of castings. Later in the day the superintendent came in for his usual conference with the chief, at which I happened to be present; and in the course of it the latter said:

While I think of it, Mack, I believe you are working out some system for insuring the delivery of castings to the shops in ample time to prevent any delays at that end in filling our contracts; but I notice that we're up against two penalties for failures this month, and I suppose the shops will blame it on the foundry, as usual. Can't you hurry up your scheme a little?

As a matter of fact, the works superintendent had been neglecting to straighten out the difficulty, which had been pretty fully discussed once before; but he had already seen enough of his superior to know that, for all his pleasant manner of speaking, three times would probably be a case of "out;" so he excused himself briefly with a reference to the pressure of other matters and, upon returning to his office, took measures to regulate the satisfactory delivery of castings.

Other defects in various branches of the company's business were gradually overcome in the same way, without causing any resentment on the part of subordinates but, on the contrary, with the

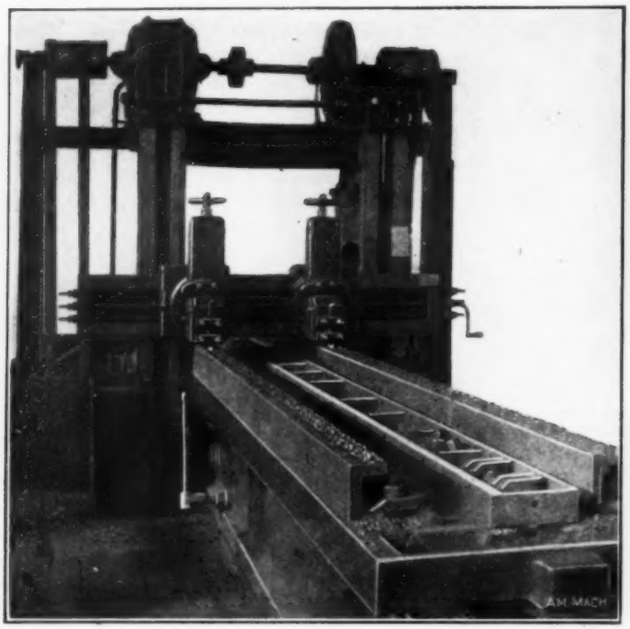


Fig 4. Planing Shoes and Wedges

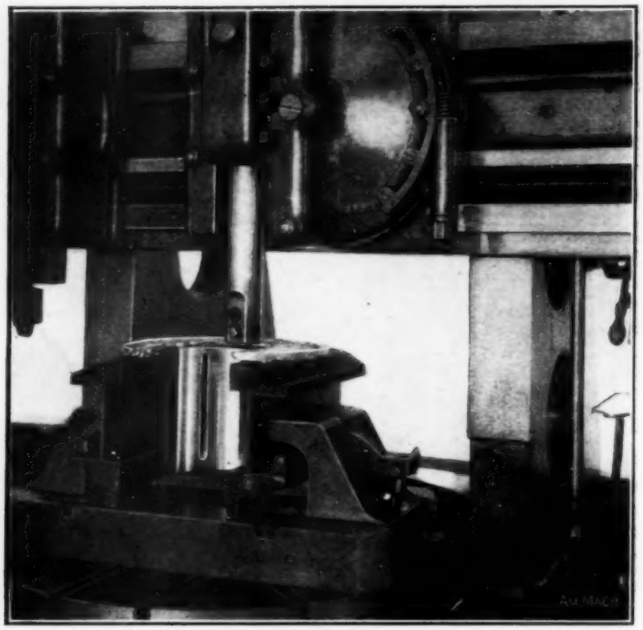


Fig. 5. Self-centering Chuck for Driving Boxes

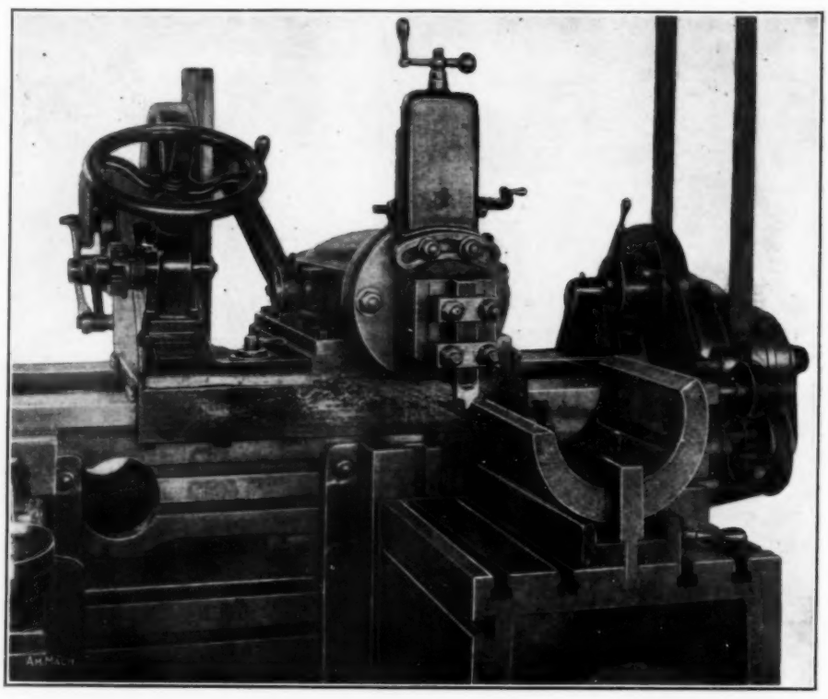


Fig. 6. Shaper Fixture for Machining Bra

feeling in their minds that they were helping of their own volition to put production and sales on a better basis than before.

Thus far the same results might, perhaps, have been accomplished in other ways, including even the hammer-and-shop to the position of responsibility he then held, he saw in his walks through the shops many opportunities for improving methods of production or the handling of material; and these ideas he conveyed in the form of inquiries of the men in charge of the va-

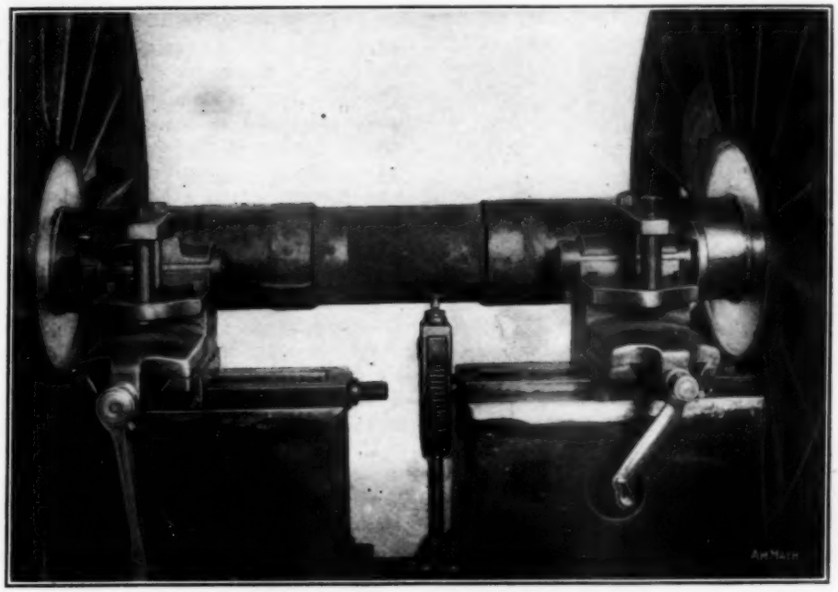


FIG. 7. DRIVING WHEEL AND AXLE TOOLS

in the company's employ, and got them to go to their foremen with anything that they had to offer.

Supplementing the observations of the general manager were those of two confidential assistants, who were not known as such but held positions under him which took them all through the works from day to day, so that they had constant opportunities to make notes of value. In no case, however, did these men "butt in" on the works superintendent's department. They passed their ideas of possible improvements in to their chief and he took them up in the same way that he did his own. He used to say in substance that:

> It is a common fallacy to assume that the greatest opportunity for reduction of expenses lies in so handling individual tools as to secure a better output. A comprehensive analysis will show, in almost every case, that the really heavy losses arise from defective shop arrangements and in the handling, apart from the tools, of raw material or finished products, including their sale and shipment and the overhead detail work, which make up so large a part of the "burden"; in fact, in all the varied lines of effort that are so largely characterized by want of thought.

It was, of course, some time before the new system began to operate smoothly.

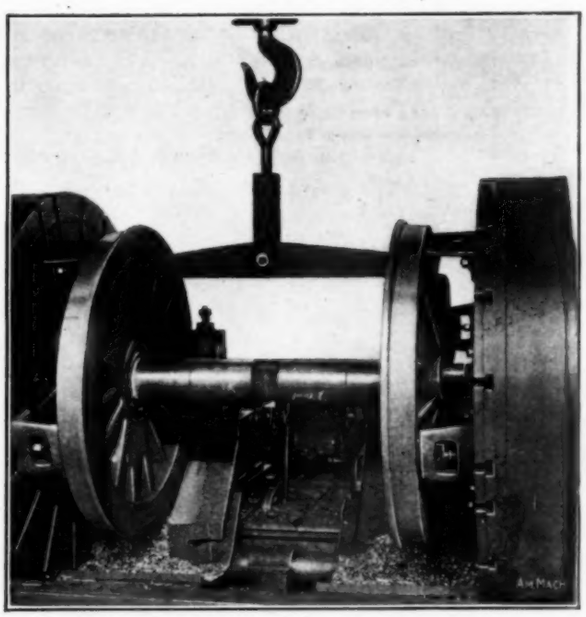


FIG. 8. LIFTING RIG FOR WHEEL LATHE

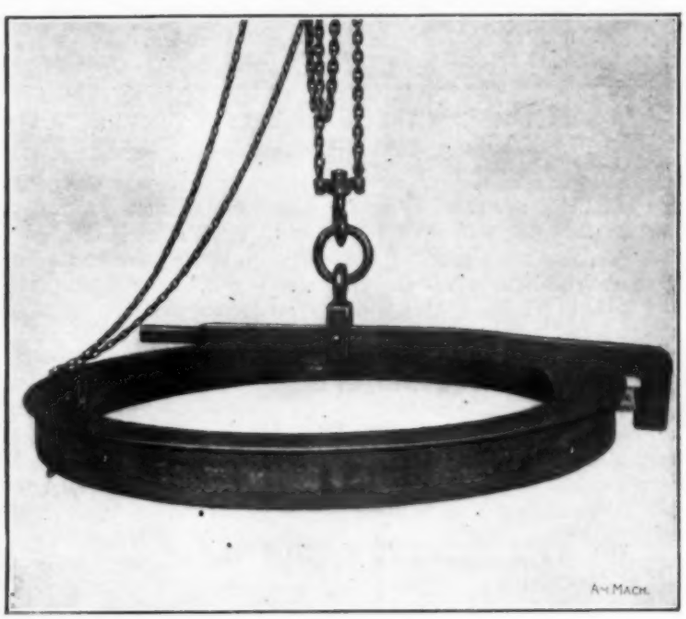


FIG. 9. LIFTING DEVICE FOR DRIVING-WHEEL TIRES

tongs method of pounding and pulling things into shape. But, with the more obvious difficulties remedied, the general manager had an opportunity, without deviating from what had come to be a smoothly operating policy, of putting into practice the real system of "suggestion" toward which he had been working.

UPHOLDING THE SHOP HEADS

As a practical man, who had risen from running a drilling machine in a railroad

rious departments; or, where he could draw out a suggestion from a foreman, told the latter to put it up to the shop superintendent and see what he thought could be done, each of the superintendents having been posted in advance that any ideas originating with their subordinates and mentioned to him personally would come to them in this way. As opportunity offered, he also had talks with some of the more experienced men at the tools, among whom were many veterans

Those who were responsible for various phases of the work often clung doggedly to the old methods of doing it, and ideas which came to them, either from above or from lower down, were often smothered. Some of the workmen and even foremen, to whom the general manager talked, thinking that they had the assurance of his backing, spoke rather pertly to their superiors and were squelched accordingly. The chief, however, had little difficulty in keeping informed of what was

going on, and the various tangles which arose were skillfully unraveled.

Active Co-operation the Result

Once the system had been well established in its rougher outlines, the man who had inaugurated it began to take his principal subordinates more and more into his confidence, opening their eyes to the reasons for the things that had been

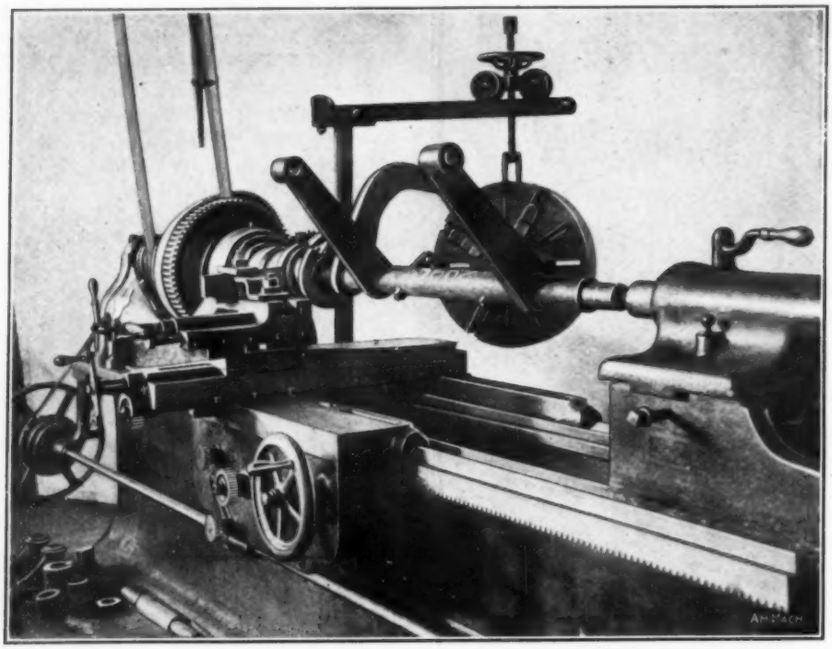


Fig. 10. Turning Journals of Tumbling Shafts

accomplished and asking them to help him elaborate the plan. This they one and all enthusiastically did. The subject, however, was not explained to them so flatly or crudely as it is here. They were led to discover many of its details for themselves, practically inventing them over again, and each one had the feeling that he had contributed largely to the new order of things himself.

From these the idea filtered downward, until it reached the men in the shops, and, as much had already been done there to put the work on a high plane of efficiency, it was simply a matter of getting them to appreciate the fact that their active coöperation in bringing about further improvements would be welcomed.

It should be added, perhaps, that the works already had a good system of piecework, the terms of which were not disturbed. So far as the operation of the tools was concerned, there had been no serious cause for complaint, and the efforts of the management were, therefore, devoted mainly to the improvement of other conditions, along the lines already indicated.

Always keep the sand used for the making of brass castings separate from that used for the making of iron castings.

Acknowledging Replies to "Help Wanted" Advertisements

By Abner Green

I would like to ask if the man who answers an advertisement pertaining to the engagement of a manager, superintendent or shop foreman, is not entitled to an answer to his application. It would be beneficial to the applicant if he knew just where he failed to meet with the requirements of the advertiser.

Let us suppose that a firm engaged in the manufacture of typewriters advertised for a superintendent. The advertisement would probably request the applicant to state age, details of experience and salary. Suppose, among the many answers, two are received from men in similar positions. Both fill every requirement, records are about equal, but the salary asked is different. One requires more than the other. It is natural that the cheaper man gets the job. It is also right that he should.

Would it not benefit the man rejected if he received a letter stating that the services had been secured of a man who, the firm thought, would meet the requirements for whatever amount he was to receive? The rejected applicant could then work with a better spirit for the firm he was with, knowing that he was doing better financially in his present position than elsewhere.

Regarding the other applicants, why should not they receive a reply stating that their applications had been received and that a selection had been made of one who seemed to fill the requirements? The applicant would then at once realize from the letterhead of the company, which indicated its line, why his application did not meet with approval. Very few advertisements give this information.

A man, in making application for a position, may answer many advertisements before he finds one that is in his particular line, and therefore attractive. Many, after a few trials, become discouraged and do not answer any more for a while. They are nevertheless men who would make good if they secured an engagement. Some might say that the periodical in which the advertisement appeared was running "fake ads." It is, therefore, the duty of all periodicals to encourage an acknowledgment of applications.

Personally, I would much rather have the management of a firm write me that it did not consider me capable than simply ignore my application. The sooner I discover where I belong, the sooner I will adapt myself to the surroundings.

If you write for a catalog to one of the many who advertise their products, you in about every case get a letter stating that the catalog has been forwarded. If this is an acknowledged form of good business principle, why is not the other?

Some time ago I sought to make a change, and answered an advertisement in the "Men Wanted" columns of the American Machinist. The advertisement gave no information relative to the line, but it looked good to me. In about 10 days I received an answer, thanking me for answering the advertisement, and also stating that the company had the place filled and that, therefore, my services could not be used.

From the letterhead I discovered that the line was entirely different from the branches of the business I was familiar with, and I would have hesitated before accepting, as I would have had to work night and day for many months to familiarize myself with that class of work. For that reason the position would not have been attractive even though my application had been favorably received.

Again, some months ago a friend of mine, who is all that one could expect as a mechanic, character excellent, and the best of recommendations, could not get an answer to any of the applications that he made. I never knew him to fail to make good in any position he ever held, yet why could he not get at least some kind of an answer from some?

With the trials of the "Selandia," built by Burmeishi & Wain, Copenhagen, the future of the big motor ship is practically assured. The "Selandia" is the largest full-powered Diesel ship afloat. Its machinery aggregates 2500 b.hp., apart from two auxiliary engines, each of 200 b.hp.

Rotary Valves for Explosion Engines

By Henry Souther*

Theory, design and construction of rotary valves for explosion engines. The results from tests are very interesting and point toward important advantages from their use.

*Consulting engineer.

Until recently the poppet valve had been considered the only feasible valve for explosion engines. Then came the internal sliding-sleeve valve, which met with far more success than was anticipated by engineers who looked into its construction. Its performance has been exceptionally fine where the workmanship has been practically perfect. Such perfection of construction carries with it a cost that is prohibitive except for automobile engines of the highest price.

This qualified success of the slide valve has encouraged many to attack the problem of displacing the poppet valve with other forms of valve action, in order to attain greater quietness and smoothness of action, increased efficiency and simplicity.

Cyrus E. Mead was working on the

FIG. 1. ROTARY EXPLOSION ENGINE VALVE

problem at the same time that Charles Y. Knight was working on his sliding-sleeve valve. It seemed desirable to Mead to eliminate as far as possible all reciprocating parts, even though relatively slow moving, in order to promote smoothness of action. Mead took up the idea of rotation, without oscillation or other intermittent motion.

The old idea of the single rotating valve was tried and it worked indifferently well. It was then that the idea of twin rotating valves was conceived; one to handle the ingoing gas and the other to care for the exhaust gas. The idea was correct in theory and has proved correct in practice. The advantages of such design are obvious—the slowest motion, with relation to crankshaft speed, could be adopted, that is, one-fourth engine speed. This is made possible by the fact that the valve is practically a cylinder with rectangular and symmetrically located ports or slots, as indicated in Fig. 1.

FEATURES OF CYLINDER AND VALVE DESIGN

The valves—inlet and exhaust—are at opposite sides of the cylinder, very much as are the poppet valves in a T-head motor, but it will be noted that there are no valve pockets with the resulting unfortunate shape of explosion chamber, as may be seen from the cross-section of the cylinder, Fig. 2. If desired, this explosion chamber may be made as nearly spherical and theoretically correct in shape as is possible with any engine.

The passage of gas to and from the explosion chamber is direct and unobstructed by sharp turns or restricted passages from the inlet manifold to the exhaust manifold. The inlet valve is fitted to its bore, through the cylinder casting, with a view to handling cool gases. The exhaust valve is similarly fitted to handle hot gases. Both valves are rotated so as to be evenly heated or cooled at all times, and reduce the tendency to warp. The water jackets of the cylinders are in close contact and surround the valves, so that the cooling is complete.

Heating under heavy loads does not alter by expansion the fit of the valve in the bore. This is very easily determined by stopping an engine after a hard run and feeling the fit of the valve in its bore. It is as free as when cold. The same is true after an easy run.

ADVANTAGES CLAIMED FOR ROTARY VALVES

Rotary valves possess many advantages. With the through ports in the valves symmetrical, conditions are certainly favorable for equal and uniform expansion, and more favorable than any one-sided form can possibly be. Uniform heating and cooling throughout the entire mass are certain.

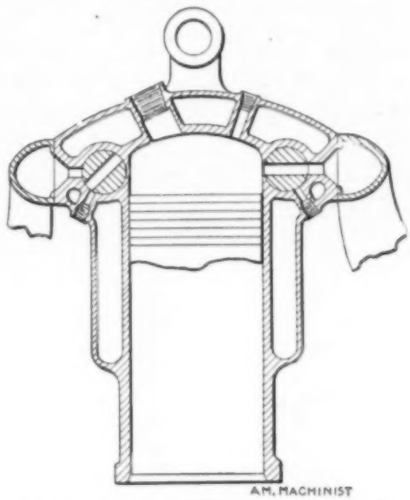


FIG. 2. CROSS-SECTION OF EXPLOSION CHAMBER OF ENGINE WITH ROTARY VALVES

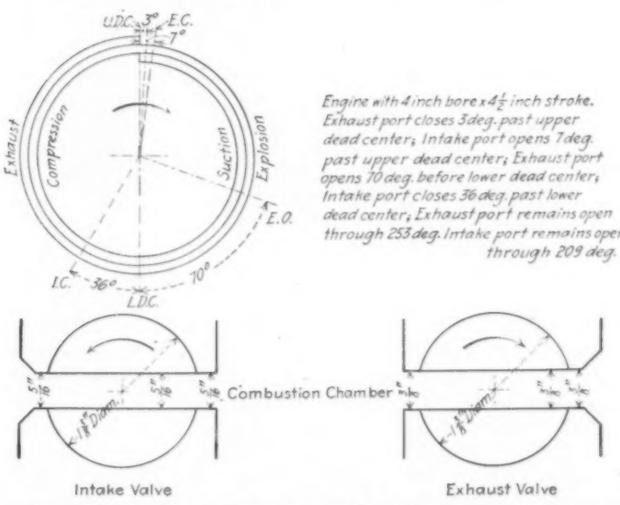

U.D.C.
3°
E.C.
7°
Exhaust
Compression
Suction
Explosion
E.O.
I.C.
36°
70°
L.D.C.
Engine with 4 inch bore x 4½ inch stroke. Exhaust port closes 3 deg. past upper dead center; Intake port opens 7 deg. past upper dead center; Exhaust port opens 70 deg. before lower dead center; Intake port closes 36 deg. past lower dead center; Exhaust port remains open through 253 deg. Intake port remains open through 209 deg.
Combustion Chamber
1¾" Diam.
Intake Valve
Exhaust Valve

FIG. 3. VALVE SIZE, SETTING AND SLOT COMBINATION USED IN TESTS GIVING RESULTS OF FIG. 5

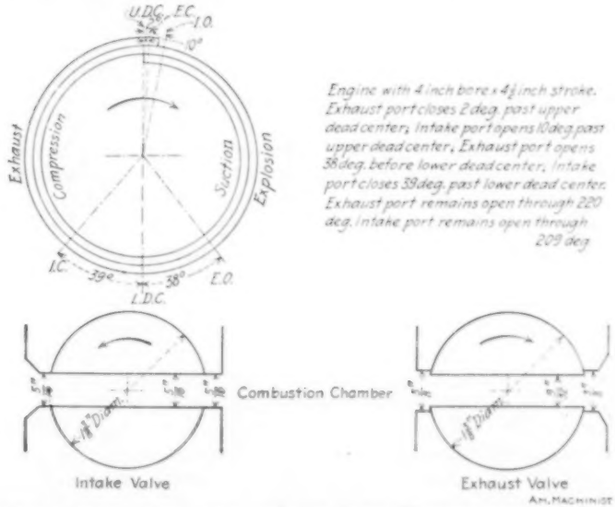

U.D.C.
E.C.
10°
Exhaust
Compression
Suction
Explosion
I.C.
39°
38°
E.O.
L.D.C.
Engine with 4 inch bore x 4½ inch stroke. Exhaust port closes 2 deg. past upper dead center; Intake port opens 10 deg. past upper dead center; Exhaust port opens 38 deg. before lower dead center; Intake port closes 39 deg. past lower dead center. Exhaust port remains open through 220 deg. Intake port remains open through 209 deg.
Combustion Chamber
1¾" Diam.
Intake Valve
Exhaust Valve
A.M. MACHINIST

FIG. 4. VALVE SIZE, SETTING AND SLOT COMBINATION USED IN TEST GIVING RESULTS OF FIG. 6

The twin valve permits change of timing the inlet and exhaust without mechanical difficulty; in fact, this could be done in a practical manner with the engine in motion, if there were a demand for this form of engine control. A suitably arranged spiral spline in the valve driving gears would alter the timing of either or both valves at will.

The mechanical construction is simple and balanced. No particular form of valve drive is necessary. It may be chain, bevel gear, spiral gear or spur gear. In a multi-cylinder engine the valves may be driven from either end of the engine or from the middle, or from several points if desired. The drive is an easy one for several reasons. The resistance is uniform and continuous, without any intermittent tendency, as with cams and other reciprocating motion. There is no tendency toward gear noises.

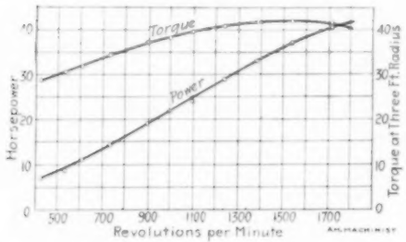


FIG. 5. POWER AND TORQUE CURVES FOR MEAD ROTARY-VALVE GASOLINE ENGINE

The power required to drive the valves is small, the bearing surface being great (the entire area of the valve cylinder less the port openings) and the total pressure very small. At any given moment there is but the explosive pressure from one cylinder on the whole valve, some compression from another cylinder and offsetting suction from another. This low pressure per square inch, coupled with slow rotation and low surface speeds, makes a simple problem of what at first glance looks complex.

The valve bores or seats do not show wear under conditions of actual service. Those that have been in use for two years show no change of diameter, but have a smooth, glossy surface, very much like a good steam cylinder.

It is apparent that an oil film is maintained entirely about the circumference of the valve at all times. In a bore of 1½ in. the valve runs with a difference in diameter of 0.0015 to 0.0020 in. The film of oil is a little less than four inches in circumference; that is, not quite two inches at both sides of the port opening, and all around the circumference of the valve cylinder at the bearings on each side of the ports. It is clear that this oil film is not to be broken down by varying pressure, as from explosion or compression.

As a matter of fact, with both the oil and the engine hot, it takes about three seconds for the film to break and show at the exhaust valve. In other words, there is no loss of pressure, either compression or effective, by or around the valves. The time available between the cycles of engine operation is not sufficient to permit loss by leakage.

TIMING OF ROTARY VALVES

The possible timing of a twin rotary-valve engine is interesting to study. Some comment has been made that the opening and closing speeds, and resulting valve opening areas, are too constricted because of the uniform rotating speeds of valves. The briefest reply is that the horsepower curve shows no signs of falling off at very high speeds, say 1800 r.p.m. This is the best proof that there is no wire drawing or throttling effect at the valves, either inlet or exhaust.

A normal poppet-valve motor, as used for automobiles, will show less power at 1800 than at 1500 r.p.m. There is a

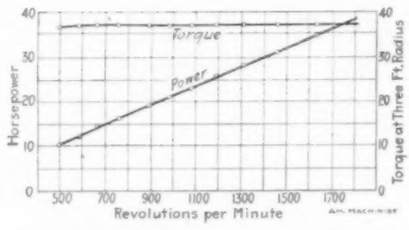


FIG. 6. POWER AND TORQUE CURVES FOR MEAD ROTARY-VALVE GASOLINE ENGINE

lag somewhere; either the springs are too slow or the cams too steep to follow at such a pace. The timing is not positive between the crankshaft and the poppet valves. It is positive between the crankshaft and the rotary valve.

It has been found that valve timing for a twin rotary-valve engine may be substantially the same as for a poppet-valve engine. The exhaust for customary speeds, up to 1800 r.p.m., should open about 40 to 45 deg. ahead of the lower dead center and close at, or a few degrees past, the upper dead center. The inlet should open a few degrees after the exhaust closes, say 10 deg. after the upper dead center, and close about 40 deg. past the lower dead center.

The control of this timing is easy and exact. It is a function of valve diameter and width of valve opening or port. In other words, a wide slot remains open more degrees than a narrow one in a given valve diameter. Proper selection holds a valve open the predetermined number of degrees and gives any desired timing.

A modified valve timing or opening is practical by having a different width of slot through the valve, as compared with the one size to and from the explosion chamber. The full extent of this modified timing has not been determined for differing valve diameters. There may be practical advantages not clear now, but so long as there is a straight-line horsepower curve up to all measurable engine speeds, and so long as the lower end of the horsepower curve produced intersects at zero on the horsepower chart, it would seem that there cannot be much gain in horsepower, at least.

The timing is determined by the width of the opening into the cylinder of the engine, in conjunction with the width of the slot through the valve. The width of the outside opening has no influence on the timing. These outside slots provide easy entrance and exit for the gases.

EFFECT OF VARYING WIDTH OF VALVE SLOTS

A series of horsepower tests was conducted on a Mead engine, built by the Mead Engine Co., of Dayton, Ohio, to study the effect of valve slots of other widths than those in satisfactory use.

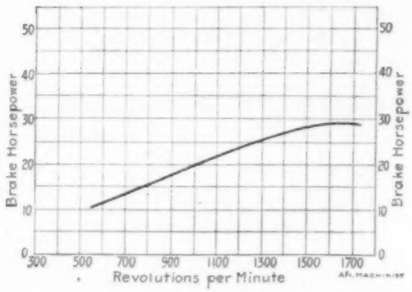


FIG. 7. SPEED-POWER CURVE FOR POPPET-VALVE GASOLINE ENGINE

There was no definite knowledge at hand as to the capacity of such valves to fill and empty the cylinders.

Surprising results were obtained. It was found that a very narrow exhaust slot would deliver the rated horsepower of the engine; also that any decrease, below normal, in the width of the inlet slot would cause a reduction in the horsepower of the engine at once.

To illustrate: The engine used was a four-cylinder, 4x4½ in., with 1⅜ in. diameter valve. The exhaust port slots were ⅜ in. wide and the inlet slots $\frac{5}{16}$ in. wide. At 1000 ft. piston speed this engine is rated (A. L. A. M.) at 25.6 hp. With $\frac{5}{16}$ in. wide inlet opening and $\frac{5}{16}$ in. wide exhaust opening, the engine delivered 26 hp. at 1000-ft. piston speed; with the same inlet and $\frac{5}{16}$ in. exhaust opening, the engine delivered 28 hp. at 1000-ft. piston speed; with the same inlet and ⅜ in. exhaust opening, the engine delivered 31 hp. at 1000-ft. piston speed. See Figs. 3 and 4.

The characteristic differences in horsepower curves that may be produced by varying the valve timing as the result of change in the width of the slots in the valves is well illustrated by the two horsepower curves shown in Figs. 5 and 6. All the conditions were the same in these tests, except that different valve openings were used.

In carrying out the test covered by Fig. 3, the inlet opening was $\frac{5}{16}$ in. wide, and

the exhaust opening was 3/8 in. wide. In the test shown by Fig. 6 the inlet opening was 5/16 in. wide and the exhaust opening 3/32 in. wide. See valve diagram Fig. 4.

The straight horsepower curve and flat torque curve approach the ideal and speak for themselves. A fairly representative curve of a poppet valve engine is shown in Fig. 7. The engine from which these results were taken is one of the standard makes of four-cylinder, poppet-valve engines, with 4x4¼-in. cylinders.

A straight horsepower curve, as stated, shows no starving as to gas supply, which result is obtained only with a positive rotating-or positive sliding-valve system. Similar results are not obtained with the poppet-valve system.

No such liberties may be taken with the rotary inlet-valve openings as with the exhaust ports. The influence of any opening less than normal is noticeable at once on the horsepower curve. At the higher normal speeds—around 1300 r.p.m. —the horsepower falls off as the result of wire drawing. There is a better performance at the lower range of speeds, but it is not up to standard. An engine with a ¼-in. exhaust port will deliver a reasonable amount of power, but if the small exhaust opening be coupled with a ¼-in. inlet port, the output drops to the neighborhood of 20 hp. at 1000-ft. piston speed on a 4x4¼-in. engine.

Valve studies have shown it to be possible to obtain any desired engine characteristics—slow speed, high torque or high speed. It is also evident that one timing of valves will cover a very wide range of speeds, such as are required for automobile engine work.

The natural question of wear arises. If the valve or bore wear materially, then the system is faulty. So far, ordinary gray-iron valves running full length on the gray-iron cylinder castings have done good work, and it has been established that the wear is not measurable in a life of 20,000 miles of automobile use. It has also been determined by experiment that there is a building up in the diameter of the valve, rather than a reduction.

A new valve was scored with a file and grinding wheel, and then put to work. After considerable use it was found that all the low spots had filled to the normal valve diameter. The material which accumulates is some form of carbon mixed with oil, and may be scraped off. At the same time, it serves in conjunction with the natural oil film to make a gastight joint between the valve and its seat.

A bulletin recently issued by the Census Bureau shows that 87,256 wage earners were employed during 1909 in the manufacture of electrical machinery, apparatus, and supplies. This was an increase of 107.7 per cent. over the number employed in 1899, the year of the preceding census.

The Taper Press Fit System

By F. A. Halsey

In connection with a general gaging system for large work from the works of the Westinghouse Machine Co., there was published in the American Machinist, Vol. 27, Part 2, page 1013, an illustration of a method of gaging taper holes for press fits which had been introduced at the same works by J. B. Thomas, chief inspector of the works.

Mr. Thomas has recently supplied additional particulars regarding other features of the taper press fit system sufficient for anyone to put it into use, and in order to make these particulars intelligible to readers who do not have the original article at hand the illustrations of that article are here reproduced.

The taper-fit system has obvious advantages over the customary straight-fit

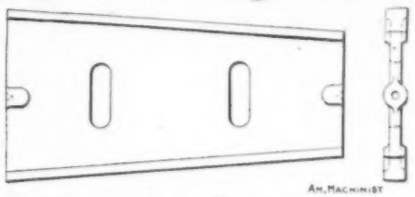


Fig. 1. Large Taper Gages

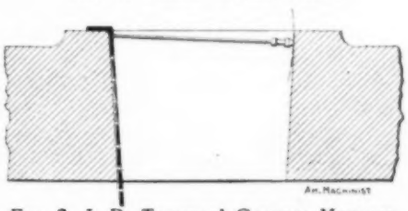


Fig. 2. J. B. Thomas' Gaging Method

system. As used at the works of the Westinghouse Machine Co., Mr. Thomas has made a useful simplification of it by a slight modification of the taper. The change in the taper is from 1/8, or 0.0625 to 0.06 in. per ft., or 0.005 in. per in., and from 1/8 or 0.125 to 0.120 in. per ft., or 0.01 in. per in. measured on the diameter.

The result of the change in the smaller taper is seen in the accompanying table of the diameters at each successive inch of length of a hole of 10-in. diameter at the large end; the dimensions in the first column being carried to four places, while in the second they are carried to three where they stop.

DIAMETERS AT EACH INCH OF LENGTH OF TAPER PRESS FITS

Taper 1/8 in. per ft.	Paper 0.06 in. per ft.
10	10
9.9948	9.995
9.9896	9.990
9.9844	9.985
9.9792	9.980
9.9740	9.975
9.9688	9.970

The slight and otherwise unimportant changes in the taper will be seen to lead to round figures for each inch of length, the figures in the second column being much more easily read from the micrometer than those in the first, while, by subtracting from the large diameter five times as many thousandths as the piece has inches of length the small diameter is obtained directly, a result that, with the taper of 1/8 in. per ft., can be found only by calculation.

A form of gage for large taper holes which Mr. Thomas prefers to full plugs, is shown in Fig. 1. They are much lighter than full plugs and with them the holes can be gaged independently on different diameters, and irregularities in the holes detected. Fig. 2 shows Mr. Thomas' method of gaging the largest holes. At the left of the hole is a carefully made strip of steel with an upturned end and a row of holes down the center, spaced 1 in. apart. The strip is used in connection with an inside micrometer as shown.

The measuremnts are not made perpendicular to the axis, but as indicated by the dotted arc. One end of the micrometer being located by a hole in the strip, the other is manipulated precisely as though the hole were straight, the frequent spacing of the holes in the strip permitting the hole to be gaged for uniformity of taper. The dimension thus gaged at the large end is the one given on the drawing as the true diameter—the microscopic difference between the dimension as called for and as made being of no importance.

The allowance for pressing home is 0.01 in. on all diameters from 10 to 30 in. The pressure required for pressing home is very variable, depending largely on the lubricant used. Thus, with fits of 22-in. diameter, the pressure required was 139 tons with heavy white lead, 706 with castor oil, and 835 with engine oil, and with fits of 30-in diameter, the tonnage, using heavy white lead, was 100, and with thinner white lead, 420.

The standard Westinghouse lubricant is one pound of white lead to 1½ pints of linseed oil, this being the mixture used with the heavier tonnages of the last case cited. The lubricant is far more effective with taper than with straight fits, due to the surfaces being entirely covered with it when they make contact. To this the great variation when using different lubricants is due.

One advantage of the taper fit is that the plug may be entered in its seat and the two compared directly, whereas, with parallel fits, the comparison can be made with gages only. Thus compared, the distance remaining for pressing home forms the best possible check on both pieces. Thus, with a taper of 0.005 in. per in. and an allowance of 0.01 in. for pressing, the plug should enter the hole within 2 in. of home, or; more generally, the distance by which the parts should not go home when they are assembled without pressure, should be 1 in. for each five thousandths of pressing allowance. The slight taper does not in the slightest endanger the security of the work.

Broaching Square Holes in a Jig

By T. B. Greene

An interesting broaching operation is shown in the illustrations. It consists of a motor-car hub detail in the shape of a flange $\frac{7}{16}$ in. thick with six $\frac{1}{16}$-in. holes, which have to be squared out to 0.468 in. The centers of the holes have to be kept good, so that a jig is necessary for the broaching operation which follows the jig-drilling operation.

The jig consists of a cast-iron plate bored to receive the check on the hub flange and also to take an adapter, fitting the machine table. These holes are bored to correct centers. Six holes are drilled and counterbored in the plate with the same centers and spacing as the work. This is to allow the passage of

Fig. 1. Broach, Holder and Cotter for Square Holes

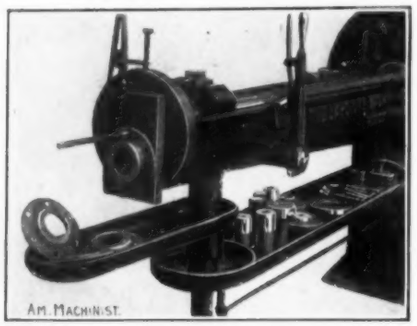


Fig. 2. Jig for Broaching Square Holes

the broach and also to give clearance for burrs thrown up on the back of the hole after broaching.

The broach holder in the machine is set true with the holes in the jig by means of a test bar, and the work is brought into alignment by the plain guide on the broach. The broach is made of a special steel, which lends itself to straightening easily after hardening, and is ground all over.

The teeth are $\frac{3}{16}$ pitch and remove about 0.002 in. per tooth. Two flats are milled on the shank of the broach to take a U-shaped cotter for pulling purposes. These flats are in correct relation to the sides of the broach, so that it may be lined up from the flats to get the sides of the square hole true with the center line of the work.

The work is turned out at the rate of 10 to 12 an hour, i.e., 60 to 70 holes per hour. Over 2000 holes have been done without the broach requiring sharpening. Roughly speaking, it is eight times quicker than filing and finishing with a sizing drift, which was the method used for finishing these holes before broaching was adopted.

Constants for Planing Time

By W. R. Gardner

An article in the American Machinist, Vol. 35, page 991, by T. E. Pray, relating to figuring planer time on some 18-ft. slabs, led me to investigate the possibility of devising a quick and flexible method of estimating the machine time, only, on planer work.

On perusing a number of past issues, it was encouraging to note the efforts that had been made to supply such a method. Most of the devices outlined required a special slide rule and numerous other devices for sensible operation; in fact, a man familiar with only the ordinary slide rule would require possibly a half day to become familiar with the new rule and its manipulation. This in itself is a drawback, aside from the fact that the average person does not understand the operation of a rule and that it would have to be constructed of materials entirely unsuited to the work.

The special rule was good in one respect; it did away with the necessity for a table of constants and the labor incidental to its preparation. But such a table is infinitely superior, as with it one can tell at a glance the constant required for any desired feed and speed.

Then, too, the simplicity of the formula, 2 × (length in inches + 6 inches) × width in inches × constant = time in minutes, is another point in its favor; all the factors are known and their use and relation readily comprehended.

No mystery surrounds the table of constants, as the same method employed in its formation is used to figure the time on any piece. For example: A plane surface 50 × 10 in.; planer cutting at 25 ft. and returning at 90 ft.; roughing cut $\frac{1}{16}$ in.; finishing cut $\frac{1}{4}$ in. A good way to secure the time necessary for one cut is to assume that the table travels at a uniform cutting and return speed; or

$$\frac{90 + 25}{2} = 57\tfrac{1}{2} \text{ ft. or } 690 \text{ in. per min.}$$

Then allowing $4\frac{1}{2}$ in. at the beginning of the cut for crossfeed and $1\frac{1}{2}$ in. for runout, making 6 in. (which is a liberal allowance) to add to the total length, we have 50 + 6 = 56 in., total cutting stroke. Twice 56 in. or the total length of cut and return = 112 in.; $\frac{112 \text{ in.}}{690 \text{ in.}}$ = time in minutes for one cut and return. Now, the number of strokes is equal to the width in inches divided by the feed, or

$$\begin{array}{l} 10 \div \frac{1}{16} = 160 \text{ roughing cuts} \\ 10 \div \frac{1}{4} = \underline{\ 40 \text{ finishing cuts}} \\ \qquad\qquad 200 \text{ total} \end{array}$$

$$\frac{112 \times 200}{690} = \textit{time in minutes} = 32\tfrac{1}{2}$$

To prove the accuracy of the table we will select the constant for $\frac{1}{16}$- and $\frac{1}{4}$-in. feed and add them, then apply the formula = 112 × 10 × 0.029 = 32½. The result is the same in each case.

When estimating on duplicate work the table is particularly valuable as it will eliminate one of the bets the estimator makes with himself on the amount of time the planer will require to perform a given amount of work. This leaves only the time necessary for setting up, tool grinding, sizing, etc., to be determined. Experience is the best teacher in the latter case.

A usual method of figuring is to allow so much time for each square foot of surface to be planed. This is taken at from one-half hour up to an hour and an hour and a quarter, per square foot, according to the degree of difficulty experienced in performing the work. While it is convenient and practically correct to use a standard figure such as one-half hour, three-fourths hour, etc., it is not theoretically correct, as can be seen from the following examples:

$\frac{1}{16}$ in. rough — $\frac{1}{4}$ in. finish, 25 ft. cutting and 90 ft. return.

A. For a piece 4x1 ft.

$$\frac{108 \times 12 \times 0.029}{4} = 9.4 \textit{ min. per sq.ft.}$$

B. For a piece 10x5 ft.

$$\frac{252 \times 60 \times 0.029}{50} = 8.78 \textit{ min. per sq.ft.}$$

The difference in results in the two cases enables one to detect a factor which evidently does not vary in proportion to the number of square feet. This factor proves to be the extra travel allowed for crossfeed and runout, which varies in proportion to the width of the piece only. To prove this consider case *A* as being 2 ft. instead of 4 ft. long, the width remaining the same or 12 in.

It is evident that the time allowed for crossfeed and runout will be exactly the same as in case *A* which, being distributed over a smaller number of square feet than before, will increase the time proportionately, or

$$\frac{60 \times 12 \times 0.029}{2} = 10.43 \textit{ min. per sq.ft.}$$

If we estimate the 2x1 piece at 9.4 minutes per square foot, it would require 18.8 minutes to finish; at 10.43 minutes per square foot it would require 20.86 minutes, or two minutes more each.

The table eliminates absolutely this variable factor and gives a true time rating to each individual piece. After several tryouts, three or four constants will eventually be memorized and used without reference to the table. These may possibly be taken direct or may be secured by interpolation when necessary.

No provision is made in the table to allow for the loss of time and speed during reversal, as no two planers operate under the same conditions and seldom have similar performances.

In estimating, if a few feet less than the actual cutting speed is used, this condition can be taken care of very readily and with no complication.

80 Feet Return Speed

Feeds		15	18	20	22	24	25	26	28	30	32	34	35	36	38	40	42	44	45	46	48	50
Two Cuts at	1/16 – 1/32	0.1684	0.1633	0.1600	0.1569	0.1538	0.1524	0.1509	0.1481	0.1455	0.1429	0.1404	0.1391	0.1379	0.1356	0.1333	0.1311	0.1290	0.1280	0.1270	0.1250	0.1231
	1/8 – 1/16	0.0842	0.0816	0.0800	0.0784	0.0769	0.0762	0.0755	0.0741	0.0727	0.0714	0.0702	0.0696	0.0690	0.0678	0.0667	0.0656	0.0645	0.0640	0.0635	0.0625	0.0615
	1/4 – 1/8	0.0421	0.0408	0.0400	0.0392	0.0385	0.0381	0.0377	0.0370	0.0364	0.0358	0.0351	0.0348	0.0345	0.0339	0.0333	0.0328	0.0323	0.0320	0.0317	0.0313	0.0308
	1/2 – 1/4	0.0105	0.0102	0.0100	0.0098	0.0096	0.0095	0.0094	0.0093	0.0091	0.0089	0.0088	0.0087	0.0086	0.0085	0.0083	0.0082	0.0081	0.0080	0.0079	0.0078	0.0077
One Cut at	1/4	0.1123	0.1088	0.1067	0.1046	0.1026	0.1016	0.1006	0.0988	0.0970	0.0952	0.0936	0.0928	0.0920	0.0904	0.0889	0.0874	0.0860	0.0853	0.0847	0.0833	0.0821
	1/8	0.0561	0.0544	0.0533	0.0523	0.0513	0.0508	0.0503	0.0494	0.0485	0.0476	0.0468	0.0464	0.0460	0.0452	0.0444	0.0437	0.0430	0.0427	0.0423	0.0417	0.0410
	1/16	0.0281	0.0272	0.0267	0.0261	0.0256	0.0254	0.0252	0.0247	0.0242	0.0238	0.0234	0.0232	0.0230	0.0226	0.0222	0.0219	0.0215	0.0213	0.0212	0.0208	0.0205
	1/32	0.0140	0.0136	0.0133	0.0131	0.0128	0.0127	0.0126	0.0123	0.0121	0.0119	0.0117	0.0116	0.0115	0.0113	0.0111	0.0110	0.0108	0.0107	0.0106	0.0104	0.0103
	1/64	0.0070	0.0068	0.0067	0.0065	0.0064	0.0063	0.0063	0.0062	0.0061	0.0060	0.0058	0.0058	0.0057	0.0056	0.0055	0.0054	0.0053	0.0053	0.0053	0.0052	0.0051
	1/128	0.0035	0.0034	0.0033	0.0033	0.0032	0.0032	0.0032	0.0031	0.0030	0.0030	0.0029	0.0029	0.0029	0.0028	0.0028	0.0028	0.0027	0.0027	0.0026	0.0026	0.0026

90 Feet Return Speed

Feeds		15	18	20	22	24	25	26	28	30	32	34	35	36	38	40	42	44	45	46	48	50
Two Cuts at	1/16 – 1/32	0.1524	0.1481	0.1455	0.1429	0.1404	0.1391	0.1379	0.1356	0.1333	0.1311	0.1290	0.1280	0.1270	0.1250	0.1231	0.1212	0.1194	0.1185	0.1176	0.1159	0.1143
	1/8 – 1/16	0.0762	0.0741	0.0727	0.0714	0.0702	0.0696	0.0690	0.0678	0.0667	0.0656	0.0645	0.0640	0.0635	0.0625	0.0615	0.0606	0.0597	0.0593	0.0588	0.0580	0.0571
	1/4 – 1/8	0.0381	0.0370	0.0364	0.0358	0.0351	0.0348	0.0345	0.0339	0.0333	0.0328	0.0323	0.0320	0.0317	0.0313	0.0308	0.0303	0.0299	0.0296	0.0294	0.0290	0.0286
	1/2 – 1/4	0.0095	0.0093	0.0091	0.0089	0.0088	0.0087	0.0086	0.0085	0.0083	0.0082	0.0081	0.0080	0.0079	0.0078	0.0077	0.0076	0.0075	0.0074	0.0074	0.0072	0.0071
One Cut at	1/4	0.1016	0.0988	0.0970	0.0952	0.0936	0.0928	0.0920	0.0904	0.0889	0.0874	0.0860	0.0853	0.0847	0.0833	0.0821	0.0808	0.0796	0.0790	0.0784	0.0773	0.0762
	1/8	0.0508	0.0494	0.0485	0.0476	0.0468	0.0464	0.0460	0.0452	0.0444	0.0437	0.0430	0.0427	0.0423	0.0417	0.0410	0.0404	0.0398	0.0395	0.0392	0.0386	0.0381
	1/16	0.0254	0.0247	0.0242	0.0238	0.0234	0.0232	0.0230	0.0226	0.0222	0.0219	0.0215	0.0213	0.0212	0.0208	0.0205	0.0202	0.0199	0.0198	0.0196	0.0193	0.0190
	1/32	0.0127	0.0123	0.0121	0.0119	0.0117	0.0116	0.0115	0.0113	0.0111	0.0110	0.0108	0.0107	0.0106	0.0104	0.0103	0.0101	0.0100	0.0099	0.0098	0.0097	0.0095
	1/64	0.0063	0.0062	0.0061	0.0060	0.0058	0.0058	0.0057	0.0056	0.0056	0.0055	0.0054	0.0053	0.0053	0.0052	0.0051	0.0051	0.0050	0.0049	0.0049	0.0048	0.0048
	1/128	0.0032	0.0031	0.0030	0.0030	0.0029	0.0029	0.0029	0.0028	0.0028	0.0028	0.0027	0.0027	0.0026	0.0026	0.0026	0.0025	0.0025	0.0025	0.0025	0.0024	0.0024

100 Feet Return Speed

Feeds		15	18	20	22	24	25	26	28	30	32	34	35	36	38	40	42	44	45	46	48	50
Two Cuts at	1/16 – 1/32	0.1391	0.1356	0.1333	0.1311	0.1290	0.1280	0.1270	0.1250	0.1231	0.1242	0.1194	0.1185	0.1176	0.1159	0.1143	0.1127	0.1111	0.1103	0.1096	0.1081	0.1067
	1/8 – 1/16	0.0696	0.0678	0.0667	0.0656	0.0645	0.0640	0.0635	0.0625	0.0615	0.0606	0.0597	0.0593	0.0588	0.0580	0.0571	0.0563	0.0556	0.0552	0.0548	0.0541	0.0533
	1/4 – 1/8	0.0348	0.0339	0.0333	0.0328	0.0323	0.0320	0.0317	0.0313	0.0308	0.0303	0.0299	0.0296	0.0294	0.0290	0.0286	0.0282	0.0278	0.0276	0.0274	0.0270	0.0267
	1/2 – 1/4	0.0087	0.0085	0.0083	0.0082	0.0081	0.0080	0.0079	0.0078	0.0077	0.0076	0.0075	0.0074	0.0074	0.0072	0.0071	0.0070	0.0069	0.0069	0.0068	0.0068	0.0067
One Cut at	1/4	0.0928	0.0904	0.0889	0.0874	0.0860	0.0853	0.0847	0.0833	0.0821	0.0808	0.0796	0.0790	0.0784	0.0773	0.0762	0.0751	0.0741	0.0736	0.0731	0.0721	0.0711
	1/8	0.0464	0.0452	0.0444	0.0437	0.0430	0.0427	0.0423	0.0417	0.0410	0.0404	0.0398	0.0395	0.0392	0.0386	0.0381	0.0376	0.0370	0.0368	0.0365	0.0360	0.0356
	1/16	0.0232	0.0226	0.0222	0.0219	0.0215	0.0213	0.0212	0.0208	0.0205	0.0202	0.0199	0.0198	0.0196	0.0193	0.0190	0.0188	0.0185	0.0184	0.0183	0.0180	0.0178
	1/32	0.0116	0.0113	0.0111	0.0110	0.0108	0.0107	0.0106	0.0104	0.0103	0.0101	0.0100	0.0099	0.0098	0.0097	0.0095	0.0094	0.0093	0.0092	0.0091	0.0090	0.0089
	1/64	0.0058	0.0056	0.0056	0.0055	0.0054	0.0053	0.0053	0.0052	0.0051	0.0051	0.0050	0.0049	0.0049	0.0048	0.0047	0.0046	0.0046	0.0046	0.0046	0.0045	0.0044
	1/128	0.0029	0.0028	0.0028	0.0028	0.0027	0.0027	0.0026	0.0026	0.0026	0.0025	0.0025	0.0025	0.0025	0.0024	0.0024	0.0023	0.0023	0.0023	0.0023	0.0023	0.0022

110 Feet Return Speed

Feeds		15	18	20	22	24	25	26	28	30	32	34	35	36	38	40	42	44	45	46	48	50
Two Cuts at	1/16 – 1/32	0.1280	0.1250	0.1231	0.1212	0.1194	0.1185	0.1176	0.1159	0.1143	0.1127	0.1111	0.1103	0.1096	0.1081	0.1067	0.1053	0.1039	0.1032	0.1026	0.1013	0.1000
	1/8 – 1/16	0.0640	0.0625	0.0615	0.0606	0.0597	0.0593	0.0588	0.0580	0.0571	0.0563	0.0556	0.0552	0.0548	0.0541	0.0533	0.0526	0.0519	0.0516	0.0513	0.0506	0.0500
	1/4 – 1/8	0.0320	0.0313	0.0308	0.0303	0.0299	0.0296	0.0294	0.0290	0.0286	0.0282	0.0278	0.0276	0.0274	0.0270	0.0267	0.0263	0.0260	0.0258	0.0256	0.0253	0.0250
	1/2 – 1/4	0.0080	0.0078	0.0077	0.0076	0.0075	0.0074	0.0074	0.0072	0.0071	0.0070	0.0069	0.0069	0.0068	0.0068	0.0067	0.0066	0.0065	0.0065	0.0641	0.0063	0.0063
One Cut at	1/4	0.0853	0.0833	0.0821	0.0808	0.0796	0.0790	0.0784	0.0773	0.0762	0.0751	0.0741	0.0736	0.0731	0.0721	0.0711	0.0702	0.0693	0.0688	0.0684	0.0675	0.0667
	1/8	0.0427	0.0417	0.0410	0.0404	0.0398	0.0395	0.0392	0.0386	0.0381	0.0376	0.0370	0.0368	0.0365	0.0360	0.0356	0.0351	0.0346	0.0344	0.0342	0.0338	0.0333
	1/16	0.0213	0.0208	0.0205	0.0202	0.0199	0.0198	0.0196	0.0193	0.0190	0.0188	0.0185	0.0184	0.0183	0.0180	0.0178	0.0175	0.0173	0.0172	0.0171	0.0169	0.0167
	1/32	0.0107	0.0104	0.0103	0.0101	0.0100	0.0099	0.0098	0.0097	0.0095	0.0094	0.0093	0.0092	0.0091	0.0090	0.0089	0.0088	0.0087	0.0086	0.0085	0.0084	0.0083
	1/64	0.0053	0.0052	0.0051	0.0051	0.0050	0.0049	0.0049	0.0048	0.0048	0.0047	0.0046	0.0046	0.0046	0.0045	0.0044	0.0044	0.0043	0.0043	0.0043	0.0042	0.0042
	1/128	0.0027	0.0026	0.0026	0.0025	0.0025	0.0025	0.0025	0.0024	0.0024	0.0023	0.0023	0.0023	0.0023	0.0023	0.0022	0.0022	0.0022	0.0022	0.0021	0.0021	0.0021

Rivett-Dock Threading Cutters

SPECIAL CORRESPONDENCE

In making the cutters for the Rivett-Dock threading tools, every attention is paid to securing the utmost accuracy. The starting point is to secure an accurate bevel in the hole, by which the cutter is held on the tool so that there can be no possibility of its not running through when it is clamped in place.

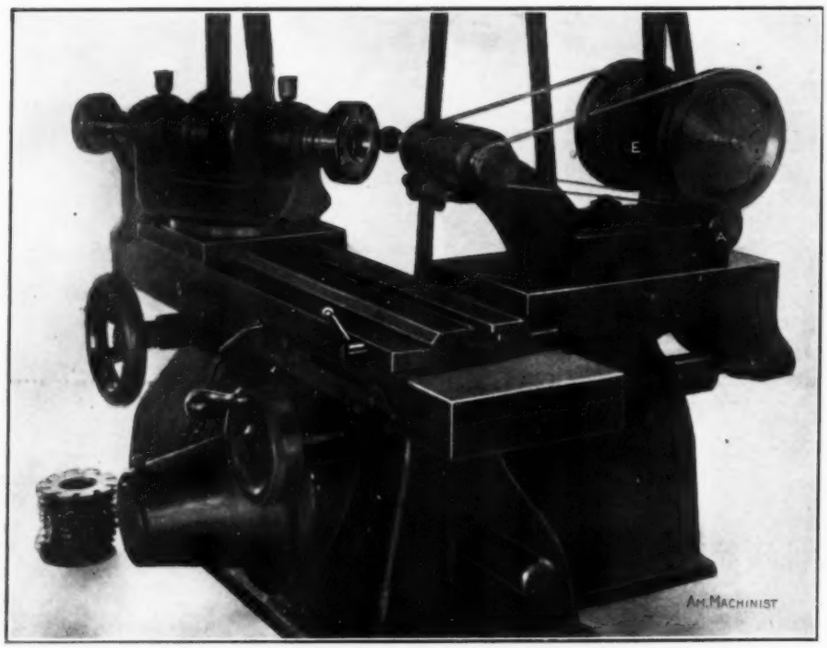


FIG. 1. GRINDING OUT THE CENTER HOLE

In order to secure this accuracy, the cutter is held in the draw-in chuck shown in Fig. 1, and the bevel is ground by the small wheel on the grinding spindle.

It will also be noted in this connection that a new form of grinding head has been adopted on the Rivett grinder, the details being shown. These heads consist of substantial castings which carry the spindle bushings in the massive arm in front. The spindle is driven by two bands as before, but rubber has been replaced by a woven fabric, in order to secure uniformity of tension, and also longer life.

The rubber bands have given excellent satisfaction in most cases, and particularly on the smaller machines, but the variation in the quality of the rubber which it is possible to secure in commercial rubber bands has made it advisable to use the woven fabric, which is shown in this case. This is specially woven to secure the best results, and is giving excellent satisfaction.

Belt tension is secured by moving the driving wheels at the back to or from the grinding spindle, this movement being controlled by an adjusting screw at the back, which is hidden by the driving wheels. These driving wheels are supported by two bearings, one each side of the central pulley, the whole thing swinging from the shaft *A*, shown at the bottom, under control of the adjusting screw.

When it becomes necessary to remove the driving pulleys and shaft for any reason whatever, it is only necessary to loosen the screw inside the further driving pulley. This releases the swinging clamp *E*, and when this is dropped down the bearing cap swings up out of the way, so that the whole driving shaft, pulleys and all, can easily be lifted out of place.

The next operation in making the threading cutters, is to grind the outside concentric with the beveled hole, and also to form the correct angles for the thread. This work is done on the grinder shown in Fig. 2, which shows how the threading cutter is mounted. It is held in place by the coned central flange, which not only centers it, but also holds it in exactly the same position as it assumes in the threading tool itself.

After being clamped in this way, the cutting edges are ground to the correct angle by the wheel shown, this angle being secured by moving the work-holding head around the indexed and graduated arc at the left. This makes it possible to secure the correct angle easily and quickly, and insures the threading cutters being true with the bore.

The difference between the old and the new grinding head can easily be seen by comparing the two illustrations. Although this is a comparatively small grinder, it is a strictly manufacturing machine, and gives results which are satisfactory, both as to accuracy and output.

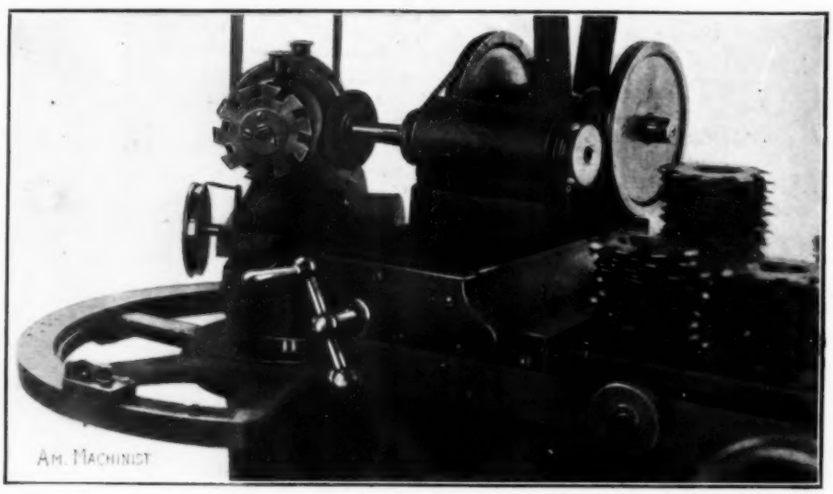


FIG. 2. GRINDER WITH NEW HEAD

In a paper before the Pittsburg Foundrymen's Association, it is pointed out that 30,000 to 35,000 wage earners die from work accidents in the United States every year. In addition to these fatalities approximately 2,000,000 men are seriously injured. It would be difficult to imagine the amount of suffering and distress these accidents bring upon the sufferers and the families dependent upon them. But the economic aspect of this subject is interesting, too. This tremendous array of casualities in a recent year cost $22,000,000 in employers' liability insurance premiums alone. This is the cost to the employer of protection. But it has been estimated that not more than 25 per cent. of the insurance premiums reach the sufferers from accident. We are, therefore, face to face with the question of how to prevent accidents and reduce the suffering and deprivation which these losses entail upon the workmen and their employers, as well as upon society as a whole.

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

A Compact and Convenient Arrangement for Storing Tools

There is little question that one of the important factors in securing increased production in any line of work is in making everything as convenient for the workers as possible. Unpleasant surroundings and inconvenient facilities probably do more to decrease the output in machine shops than most managers realize.

The illustration shows an equipment

CONVENIENT DRAWERS UNDER THE BENCH

which has proved extremely convenient in our shop. The four small drawers under the bench are a big improvement over the usual tool box or the tool maker's grip. They save bench room, and in this case eliminate placing the box in front of the window, something that should always be avoided when possible.

Then, too, it is advisable to make the surroundings as attractive as possible. The whole shop should be reasonably clean and well lighted. Furthermore there should be no rulings against attractive calendars or other pictures, which add to the brightness of the surroundings. I am firmly convinced that a little attention to such apparently trivial details will prove a paying investment in a great many shops.

CHARLES SEHL.

Philadelphia, Penn.

Types and Uses of Limit Gages

In laying out a system of limit gages for interchangeable manufacturing, much time and consideration must be given to designing so as to produce them at as low a labor cost as possible and still keep their efficiency up to the point required.

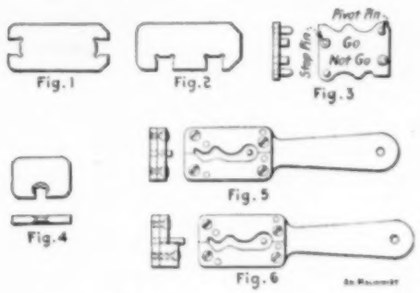
Considerable space in print has lately been devoted to the question of gages and gaging methods, and the double-end limit plug gage is too well known to require attention, so I shall confine my remarks to some types of gages are not so well known.

Consider a certain component part, upon which there are required to be performed, we will say, twelve operations; it will be found advantageous in order to obtain the highest efficiency, to make separate and distinct gages for each operation, thus doing away with the necessity for one operator borrowing from another and the two operators, perhaps, wanting the same gage at the same time, thereby decreasing production by one waiting for the other.

Again, when a gage is made to be used for testing the work done in several operations, it will be found that certain cuts are gaged more frequently than others and when the gage is turned in for adjustment or repairs, it would mean that gages for all operations are turned in and that they cannot be used until such repairs have been made.

The illustrations show several gages of the limit type, which find extensive use in many of the large factories engaged in the production of small, accurate interchangeable parts.

Referring to the illustrations, Fig. 1 shows a type of limit snap gage, with which all gage makers are more or less familiar. It is made of machine or tool steel, preferably the former, pack hardened and the two limits ground, one in each end. This type of limit snap gage has been displaced by the type shown in Fig. 2, on account of the ease of milling both slots at the one setting and the ability to grind both slots without taking the gage out of the vise, not to mention the fact that the gage does not have to be turned end for end when used in testing the work.



LIMIT GAGES FOR INTERCHANGEABLE WORK

In the milling of irregular forms, where such forms are mainly for clearance for other parts, and which throughout their length, have only one or two important points which are to be used in the operation of the other parts of the mechanism, the gage shown in Fig. 3, has been found to give excellent service. It consists of a flat plate having both edges fitted to the model part whose outline it is desired to reproduce and having the hinge pins and stop pins located at such a distance from the outlined edge as will give the desired limits within which it is found necessary that the work be machined, the outline being, of course, formed by the use of eccentric relieved cutters, wherever possible.

In Fig. 4, is shown a most useful gage for determining the position of a radius cut in relation to the thickness of the piece upon which such radius cut is

made. The width of the opening is made equal to the figures used for the maximum thickness of the piece of work and the radius is then formed in the bottom, as shown, being cut back on each side, reducing the thickness of the gaging portion to about $\frac{1}{16}$ in. After hardening, the radius is fitted to a master male gage until it shuts out light when reversed.

In Fig. 5, is shown a type of receiving gage, well known to those employed in the interchangeable manufacture of firearms and other parts of irregular outline. It is constructed by taking a flat plate, which forms the base and handle and placing thereon two or more separate blocks which have previously been fitted to the model part, duplicates of which it is desired to gage. These blocks, after being fitted to the model, are drilled and reamed for screw holes and dowel pin holes and then hardened, after which the formed surfaces are corrected to the model and the dowel pin holes lapped out to the proper size.

The dowel pin holes are then transferred to the base plate, together with the screw holes. The model is next inserted and the hole for the locating pin is transferred from it. This pin is hardened, ground and lapped to the minimum diameter allowed for the hole in the work and must be straight and of uniform diameter, care being taken to see that it is inserted so as to stand in the same plane as the inside surfaces of the blocks. This gage can only be used when all outside surfaces have been milled and consequently is of use only as an inspection gage, not as a gage which can be used in the manufacturing departments where it is desired to gage each edge of the work when milled.

Fig. 6, shows an improved modification of the type of receiving gage shown in Fig. 5. The side which is first operated on in the milling, projects above the face of the other half an amount equal to the thickness of the piece to be gaged. By this method of construction it is possible to gage the first cut independently of the second cut and not have to wait until both cuts are made before inserting the parts into the gage. It will be found that the type shown in Fig. 5, gives better service as an inspection gage than the one shown in Fig. 6.

CHAS. F. SCRIBNER.

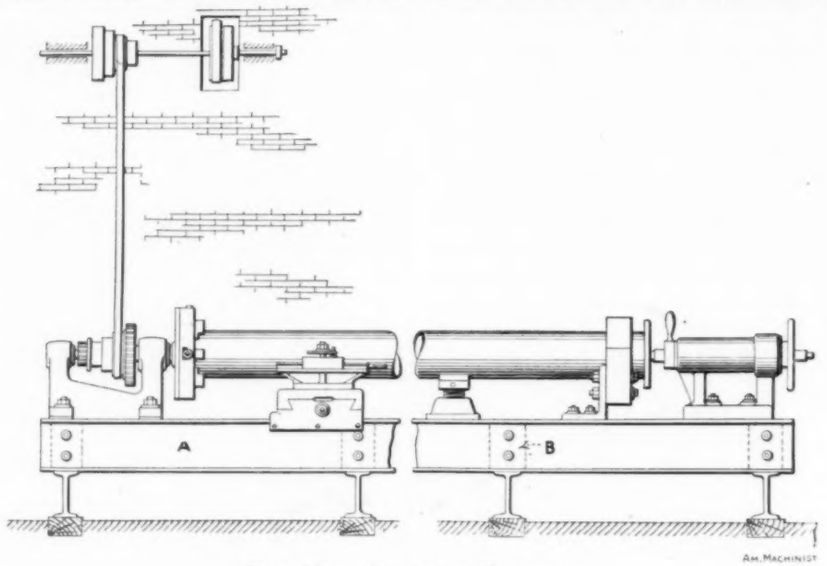
Hartford, Conn.

Making a 53-ft. Lathe

In our shops we had some seamless wrought-iron tubing of 5- to 12-in. inside diameter and up to 46 ft. long, which we wanted to straighten, or true, and to bore out at both ends to take journals.

We had recourse to the improvised lathe here illustrated. This was originally located in our heavy-turning building, where, because of its great length, it not only took up much space but where the moving about of the large, heavy tubes was extremely inconvenient and interfered with the work in the shop. We therefore concluded to take this lathe out of the building and to install it along the outside wall under a protecting roof put up for the purpose.

The illustration shows this lathe in its position along the wall of the factory



THE 53-FT. LATHE IN POSITION

building. Here *A* indicates two I-beams laid accurately, close together, which are long. The two beams are bolted a certain distance apart through the braces or spacing blocks *B* and rest on five I-beams, acting as cam supports. The last mentioned rest on strong sills or sleepers as a foundation. This understructure, although a makeshift, was very strong and solid. The head and tailstock and rest used were taken from a strong old lathe. The drive of this improvised lathe we led directly from the interior to the outside of the building, connecting the countershaft by a belt with the line shafting inside.

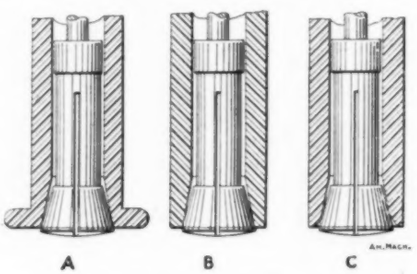
The tubes were held in the jaws of a faceplate at the head end and by an expanding arbor introduced into the tubing at the tail end. For the long pipes and for cutting-off purposes, there were also placed under the work steadies, shod with lignum-vitae and resting on the I-beams. All further arrangements are plain enough in the diagram. This improvised lathe for tubing has become indispensable to us. It could be used also for other work, for example, straightening, cutting off or facing extraordinarily long work in which a high degree of accuracy was not required.

Erfurt, Germany. C. KUHN.

A Simple Solution and a Simple Explanation of a Problem

Recently in Hartford, Conn., I was talking shop with a couple of well known machine-tool men, one of whom was Mr. Hanson, of the Pratt & Whitney Co. The conversation turned to spindles and draw-in collets and Mr. Hanson told of an experience of his.

"In a certain machine which we were making the spindle end was provided with an external flange or collar of sufficient strength to withstand the stresses caused by the drawing in of the collets. Owing to a change of purpose it became necessary to make the spindles without this flange. Trouble followed at once, and spindle after spindle was split or cracked by excessive tightening of the collets. The matter was then brought to my attention and a spindle was made without a flange but slightly bell-mouthed so that the collet did not bear at the end of the spindle, but a little back from the end. This construction proved perfectly



THE SPINDLES AND COLLETS

satisfactory and no more spindles were cracked."

"What is the reason?" I asked.

Taking a piece of paper with the edge of it between the thumb and forefinger of each hand, Mr. Hanson with little effort tore the edge, then he shifted his hands till the grip of each thumb and forefinger was in the middle of the sheet and by exerting considerable force he was able to tear or split the paper. "That's the reason" he said.

Now lots of men would have gone deeply into "the underlying principles,"

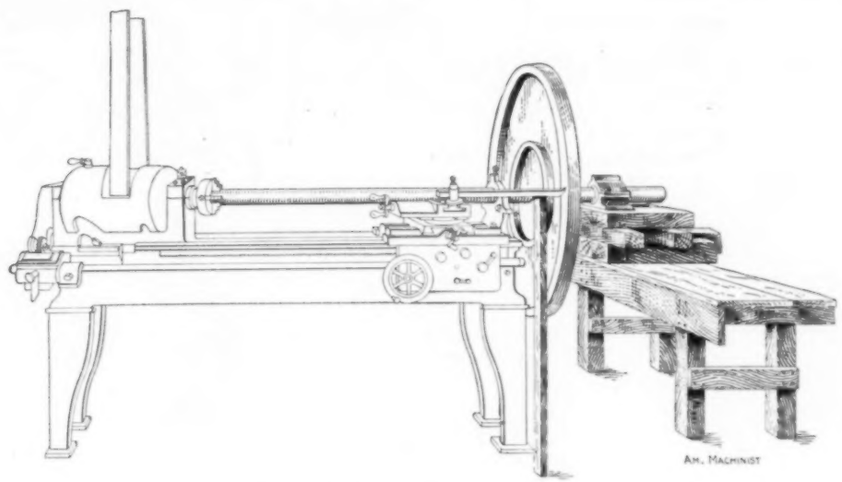
analyzed the real and imaginary stresses and bewildered themselves and their hearers with a lot of "bunk" theories but this kind of man does not arrive at such a simple solution and cannot explain such a simple solution so simply.

In case anyone is not able to follow my description, the cut shows at *A* the original spindle; at *B* the spindle which split and at *C* the spindle which was prevented from splitting by being bell-mouthed.

New York, N. Y. E. A. DIXIE.

Turning a Large Job in a Small Lathe

The cut illustrates some work that was done at the Millville Bottle Works on a 16-in. Lodge & Shipley lathe. The work turned was 4½ ft. in diameter and as we found that it chattered a little we put a bearing on a bench in back of the work as shown; after which the work progressed quite smoothly.



LARGE WORK ON A SMALL LATHE

CLIFTON CARLISLE.

Millville, N. J.

Disparity and Unreliability of Gages

At present I am in charge of a machine shop, one of whose specialties is a hub or wheel, which has to be bored to suit engine and motor shafts made by firms scattered pretty well all over the world. Consequently, I have always on hand a variety of gages, from the modern limit gage to the double-pointed rusty nail.

During recent years, the question of gages has been thoroughly considered by most firms, and nothing but the finest are of any use if interchangeable work is desired. Most firms insist on this in their own shops. It therefore hardly seems reasonable to expect the other fellow to produce satisfactory work, that in many cases must pass close government inspection with anything but the finest gages.

I do not find any one country that is more advanced than another in this matter. The most rusty nails come from Russia; Japan also sends a good number, but they are covered with crosscut chisel marks which no one understands, so we avoid a certain amount of worry, and do a little extra guesswork. From some German firms we receive splendid gages, which make it a simple matter to supply what is wanted, but this does not apply to all.

Quite recently I received from one firm, through its London agents, a piece of plain wire, pointed at both ends. No marks of any sort could be found on it. Careful measurement showed it to measure 2.753 in., and I concluded, somewhat hastily, perhaps, that the makers required a wheel to fit a 2.750-in. shaft, the pointed wire to be used a tight fit (without travel) in the bore. I worked accordingly, and the wheels were forwarded.

About a month later, international complications commenced, and I had to explain away a letter which stated, "that the wheels would not look near their 70 mm. shafts, and could not have been bored to the gages sent." In reply to this the firm wanted to know "whether to return the wheels or rebore them and debit you with the cost."

As I long ago found it necessary to keep a record of all gages received and full particulars concerning them, the evidence in this case was far too strong to implicate us in the matter. The firm was left to work out its own salvation. This, however, was poor satisfaction for me, and I thought of the beautiful set of gages I induced my firm to buy from Germany, on one of which is engraved: 70 mm. = 2.7559.

During the past two or three years, I have fitted a large number of wheels on motors made by a leading American firm. I have gaged a large number of its shafts without finding any error. In fact, one batch of motors came in all dismantled, bearing covers off, armatures out, etc., and we assembled these without looking for any markings—it was not necessary.

Knowing this firm's standard, I do not use their gage, our wheels being made to limit gages of our own, suitable for (in this case) a 2-in. standard shaft.

From them, or their agents, I have a beautifully made point gage, marked 2 in. Probably it was correct when made, but when received it measured 1.9995 in., and, compared with their shaft, it is 0.0005 in. small. Assuming that it is 2 in., is it possible for me to instruct, and the workman to bore, the hole correctly? If I can, why use limit gages?

Many British motor firms send out the same type of gage, and the other day we received a complaint from one, "that the wheels were bored small, and that we could not have allowed the necessary travel on the gage." What is the necessary travel? Many years ago I heard of a so called Birmingham standard for point gages, which, if I remember correctly, was to allow $\frac{1}{16}$-in. travel to the inch; i.e., a 2-in. point gage, if made the exact size of the shaft, one end should travel ⅛ in. across the bore, while the other remains stationary.

It is, however, impossible to rely upon this, as every man has a different idea as to what sort of point should be used, varying from the end of a poker to the point of a needle. Many workmen have different ideas as to what constitutes an eighth across the bore of a hole. For this reason this form of gage must always remain unsatisfactory, and how it has survived the introduction of limit gages, universal grinders and tool rooms is a sort of Chinese puzzle, which mystifies the other fellow in more ways than one.

We send out a lot of gages ourselves, and the point gage was long ago banished from our toolroom. In its place was substituted a gage made from ½x1-in. rectangular cast-steel bar. This was sawed through to length, a hole put in the center, then hardened, after which it was put on a handle or mandrel and ground to size in the universal grinder. This occupies about one-half the time that a tool fitter would spend on a point gage.

We have about 150 sets of these gages, including a keyway gage. We send them to anyone and have only lost three sets in two years, one of these being lost in transit. If a shaft gage is required, we supply one from ¼-in. plate, having a hole the correct size of the bore and a keyway the correct size of the one that will be found in the wheel that is to fit the shaft, and althoukh I am continually in trouble with gages, I have the satisfaction of knowing that others are responsible for making something they cannot or will not use in their own shop.

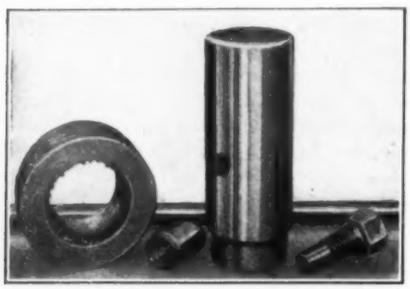
Belfast, Ireland. F. P. TERRY.

Withdrawing Helical Timing Gear from Crankshaft

The illustration shows a device for removing a helical timing gear from a crankshaft. The gear comes up against a shoulder on the crankshaft and has only $\frac{1}{16}$-in. clearance from the crank case, which makes it difficult to remove.

The gear is a ten-tooth helical wheel. The angle of the tooth is 63° 26″, which makes a knife edge on the ends of the teeth and so does not allow hammering, which at best is a destructive method and in this case results in a good many scrap gears.

The only method of removal seemed to be something in the shape of a nut fitting the gear and which could be drawn off by pressure against the end of the crankshaft. Cutting a multiple thread



DEVICE FOR WITHDRAWING HELICAL TURNING GEAR FROM CRANKSHAFT

nut of this description, i.e. with 10 threads of very steep lead, on the lathe was out of the question, being more or less a trick job and a costly one to boot, involving rigging up a lathe especially for the job.

A ring was turned, screw cut and bored, the bore fitting the gear easily. The threaded portion of the ring was made to fit the sleeve, which is shown clearly in the halftone. The ring was then screwed on a mandrel and placed between the center on a universal miller geared to the same spiral as the gear. A couple of lines were scribed on the ring representing a tooth of the gear, and three holes were drilled and reamed $\frac{1}{4}$ in. in diameter and equally spaced along the path between the lines. These holes represented one tooth. Nine more sets of holes were drilled and reamed, completing the drilling of the ring or nut.

Thirty pegs of $\frac{1}{4}$-in. drill rod were then chamfered at one end, fitting the space between the gear teeth. The pins were oil toughened, and driven into the holes round the ring, the points standing through into the bore forming the thread of the nut. The thread as formed by the pins is seen clearly in the illustration.

A $\frac{7}{8}$-in. setscrew, fitting the end of the sleeve, completed the arrangement. This screw carries on its end a brass pad to prevent damaging the end of the crankshaft. A method for preventing these pads from falling off the end of the pin is employed. The hole in the pad is drilled and reamed to size and then opened out a few thousandths bigger, $\frac{1}{8}$ in. back from the open end. The pin is made 0.002 in. large and has a smaller diameter at the back end of the plain part. The pad is forced on until it comes to the small diameter, where it becomes an easy fit.

This is far cheaper than pegging and grooving and is more satisfactory. In use a tommy bar is required to prevent the nut backing away off the thread under the pressure of the screw. A gear well driven on can be removed by one man in two or three minutes without damaging the gear in the slightest. The fixture can be used in position on the completed engine without having to dismantle except to remove the gear cover.

T. B. GREENING.

Coventry, England.

A Pair of Crank Throws

The diagrams show a pair of crank throws or false centers.

The boys here make a small three-horsepower gas engine. When it came to turning the crankpin, I found that it took too much of my time showing how to set a pair of throws in position. The usual kind with a setscrew, would not do the work, as the students were not careful of the setscrew ends securing the work and would move the tool into the filleted corners causing the lathe to slip the belt and pull the throws out of line.

The type illustrated consists of two pieces of mild steel, case-hardened; the holes for the shaft and the center holes *C*, Fig. 1, are in line square with the

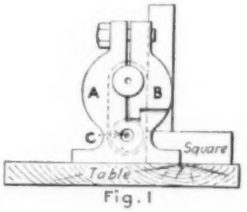


Fig. 1

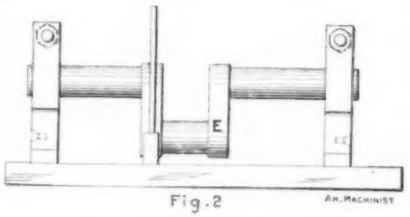


Fig. 2

A PAIR OF CRANK THROWS

base. By tightening up on the screw the piece *B* forces the shaft against the piece *A*. Placing the two throws on a table with the crank in position and squaring the sides of the crank throw *E*, Fig. 2, with the table, is all there is to do.

This method has given great satisfaction as it holds the shaft without securing the ends and is free from that screwing action that causes the center holes *C* to creep out of line when the setscrew is tightened as in the other kind of throws.

WM. B. KELLEY.

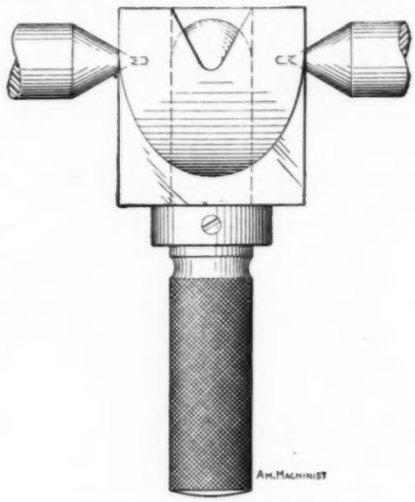
Notre Dame University, Notre Dame, Ind.

Grinding a Round-End Plug

Not long ago I made a grinding fixture that may be of interest to the readers of the AMERICAN MACHINIST.

The work was in the form of a plug gage, 1.375 in. in diameter, perfectly hemispherical on the end.

At first I was inclined to use the circular-cutter grinding attachment, but I soon discovered it would take considerable



GRINDING ROUND-END PLUGS

work to arrange for that, so I made something simple, which can be used on any grinder that is equipped with centers.

After the gage had been machined to within grinding allowance, with a center projecting beyond the radius, it was hardened and ground to the proper diameter. It was then inserted in the fixture shown in the cut, with a collar on it, as shown, to prevent slipping in too far, and also acting as a gage while in operation. The handle of the gage was then moved up and down, turning the gage in the block slightly at each movement.

In order to get the desired result, the centers and hole in the fixture must be in perfect alignment. This is easily accomplished by using one face for the two centers, and the hole on an angle plate bolted to the faceplate of a lathe, without changing the distance from the angle plate to the center during the operation of boring.

To some, the grinding of the gage this way may seem like a rather tedious operation, but it was surprising how quickly it did the job.

Detroit, Mich. A. W. FOSTER.

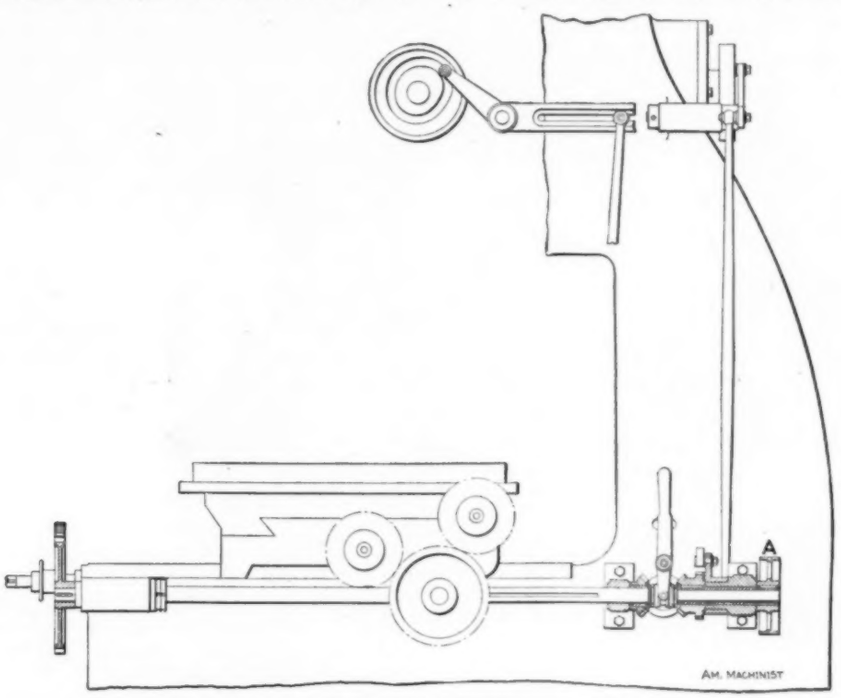
Discussion of Previous Question

Referring to letters and articles previously published

A Vertical Milling Attachment

The vertical milling fixture for the slotter described in Vol. 34, page 1128, can hardly be used for the majority of slotters without altering the feed.

From a statement indicating that the conversion was to be made with a slotter equipped with all the necessary feed motions of a standard machine, it might be assumed that the feed motions of the slotter were to be used for the milling fixture without change.



THE ARRANGEMENT FOR CONVERTING THE FEED

This cannot be done, since the engagement of the feed in slotting takes place when the tool is out of the work, and therefore the time during which the feed operates is proportioned as short as possible in order to limit to a minimum the time running empty. Hence comes a short jerky feed which is not adapted for milling. The time of feed is longer only in the case of the few slotters that are provided with means to lift the tool and on which, therefore, the entire return of the ram may be used for feeding. Even this would not give a perfectly satisfactory feed motion for milling.

The feed motion on slotters such as are commonly in use can be changed very simply and without great expense, by means of a one-sided cam, a pawl and reversing mechanism, without thereby affecting the time required for mounting and dismounting the fixture. Since, however, by a somewhat more improved method of effecting the conversion, it is easy to make a fixture possessing the mechanical and quick adjustability of the power traverse, it will pay, even for slotters alone, to make the conversion according to either of the two following methods:

I. If the teeth of the ratchet are straight, a serviceable milling feed may be made by constructing a two-ended pawl. The pawl is then turned toward the opposite side, as in slotting, and we may lay out the quick, short path of the cam and then its slowly rising path used for engaging the pawl in milling.

II. A more improved modification of the connection is possible by placing the pulley *A* on the hub or bushing of the clutch. The pulley then works on the splined shaft as a loose pulley, which, through the clutch of the reversing mechanism, may produce a right or left rotation of the splined shaft, and thus a progressive, regular feed, entirely proper for milling.

The changing over of this fixture from slotting to milling requires only a throwing off or on of the belt for the feed motion if one does not care to provide a clutch or friction coupling. It may be found useful to connect the reversing lever for the clutch of the reversing mechanism with a rod, which enables the workman to operate it quickly and conviently from his position. This rod can readily be provided with stops for automatic release.

Frankfort, a.M. WM. BARTHOLD.

He Wanted Smoke

In Vol. 36, page 117 you publish a few editorial remarks under the heading "Smoke in the View of the Works." Passing over the views therein expressed on smoke (which cannot be diminished as easily as the writer intimates) there is a further reason for the introduction of smoky chimneys into those wonderful views of the vast factories that one so often sees. The following incident discloses it:

My firm was asked by one of its continental agents for some pictures of itself wherewith prospective customers might be impressed. Not having had its picture painted since babyhood (it is now 134 years old), a willing artist was commissioned to make the best of a poor job. When the final "wash drawing" (I think that is what he called it) was produced for inspection, "the firm" declared that it had never before realized what a beautiful and big thing it was. Believe me, Sir, that picture would have awakened "the glad eye" of the president of the Smoke Abatement Society, for there was *no* smoke!

With the haste of expectant praise "the firm" hurried off the proof to the agent for his formal approval before introducing the picture to the admiration of the public.

But alas! Though the reply was formal enough, however carelessly read, it could not be construed into approval. In indignant, bitter and broken English it asked "the firm:"

Did it expect him to show his respectable customer that picture?

If so, what sort of opinion did it think the customer would have of a place where the chimneys gave forth no smoke?

Did it not know that the bigger and more honorable the factory, the greater the amount of smoke required?

What were the chimneys for, anyway?

And so, in defiance of the smoke inspectors and factory acts, the now unwilling artist was instructed to give to every chimney its full quota of smoke, and

where no chimneys existed to fill in the blanks with clouds of beautiful white steam that made the agent happy but nearly caused the death of the engineer when he was subsequently introduced to his copy.

The story is founded on a true and recent occurrence and explains why one firm has fallen from the smokeless ideal in its "view of the works."

Sheffield, England. A. E. TENNY.

V-Thread Gage Limits

I noticed in Vol. 36, page 188, the article "Limits for V-thread Gages," by P. A. Fredericks. He says "Persistent inquiry in various directions brought forth the fact that tap manufacturers universally figured pitch diameters from the formula: Double depth = 1.616 pitch."

I am quite sure that, unless recently adopted, none of the well known tap makers uses the formula given, or at least makes taps to conform to it. There are no two tap makers whose V-thread sizes are all alike.

Starting with the ¼-in. 20 size mentioned by Mr. Fredericks, the pitch diameters of the taps made by the leading makers vary from 0.209 up to 0.217 in, and so on up through the list. Some time ago this matter was quite thoroughly presented in the AMERICAN MACHINIST. At that time a table was published showing the pitch diameters of V-thread taps as made by ten of the best known makers. A reference to this should show Mr. Fredericks that the formula he gives is not used.

This leads to the question: What possible reason can there be, when establishing standards, for attempting to do anything with the V-thread? Many of the innumerable V-thread standards are standard only in the shops in which they are made.

There are some conditions surrounding the use of the U. S. Standard form of threads that lead to slight misunderstandings, but the average results are certainly proving that this is by far the most practical form that has yet been developed. The only real trouble seems to be that we have a standard without understood allowances, and opinions as to what these should be differ very little.

JOHN E. WINTER.

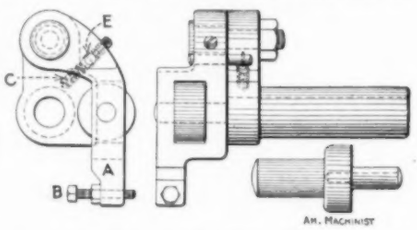
Wrentham, Mass.

Concerning Knurling Tools for the Screw Machine

I have read with considerable interest the recent articles by S. N. Bacon. The one on "Knurling Tools for Screw Machines," is very good, but, Mr. Bacon is in error when he says, in Vol. 36, page 295: "The flange on the piece shown in Fig. 4 prevents knurling from the turret." I have done several jobs of this kind, and have always used a turret knurling tool.

Now with the knurling tool shown in Fig. 4 of his article it would seem impossible to use a forming tool in the front tool post, and that is certainly a disadvantage. I would deem it a favor if Mr. Bacon would say how he formed the piece in question, as judging from the length of the piece, it would be out of the question to use a combination cutoff and form tool. The only other way that I can see would be to use a swinging tool in the turret; but then, where would you put the former plate, if, as already stated, the knurl-holder was in the front tool slide?

Having a large quantity of brass plugs to make like the one shown in the illustration, I designed the swinging knurl-holder, also shown, which is really a knurl mounted on the well known Brown & Sharpe swing tool.



A SWINGING KNURL HOLDER

In this the turret advances the tool into position, and a former plate, screwed onto the front tool-post raising block, engages with the adjusting screw *B* on the swinging member *A* which carries the knurl. Then the turret advances the desired distance, after which the front slide drops back to its normal position, and the coil spring *C*, in the knurl-holder, acting on the pin *E*, returns the gwinging member *A* to its normal position, and when the turret revolves it is obvious that the knurl will not strike the flange on the work.

The same swinging tool, with little alteration, could be used for internal knurling operations. All that is necessary is to make a new swinging member to carry the knurl. I think it good practice to keep a quantity of these swinging members, made to carry various tools and to fit the same body. They are good tools, and save considerable time and money and do away with a lot of special tools which are made for one job only.

In conclusion I wish to say that the eccentric knurl described by Mr. Bacon is certainly a novelty and I hope to see more of his articles.

Newark, N. J. C. H. GORDON.

Jig and Fixture

I read with great interest your article dealing with the difference between jigs and fixtures. I think Webster's definition is "way off." Why small? I have known jigs which had to be lifted with a hoist. Hardened steel surfaces to guide the tools are not an essential. A turning jig holds the piece in such a manner that the tool is working about the right center, but usually acts in no way as a guide to size, which is determined by a gage or traverse stop, which forms no part of the jig.

The difference between a jig and a fixture is that a fixture in no way influences the tool but merely holds the work rigidly in a position convenient for correct operation.

Jig: An appliance used for positioning and firmly holding a piece to be operated on in correct relationship to the tool.

Fixture: A specially constructed clamp for securing a piece to be operated on in such a manner that the tool may be fed in to operate correctly.

I think these definitions just about cover the ground although there is a point at which the two practically converge; as, when a milling fixture has a stop to set the cutters up to.

JOHN F. HULL.

Sheffield, England.

Explanation of an Explosion

With reference to an illustrated account of the peculiar explosion of an automobile-engine cylinder in Vol. 36, page 148, I venture to offer the following possible reason, based on an acquaintance with a well known make of engine of the same power and apparently the same design.

I was once much puzzled for a short time over a complete loss of compression in the front cylinder of one of these engines, and it was not until the engine was dismantled that the trouble was located under the top piston ring. The rings were supposed to be prevented from turning by small pins screwed into the piston casting and projecting into the slot in the piston ring.

The holes in the casting were drilled through the whole thickness of the piston wall, and one of these pins under the top ring had come adrift and disappeared, so that the gasses from the cylinder head passed directly through this hole into the crank case. Examination of the remaining pistons revealed a pin missing in each, but the piston ring had turned so that the gap in the ring was no longer opposite this hole in the piston wall.

It is possible in the case under discussion that this same trouble was present and that the explosive mixture accumulated below the piston and was ignited there from the burning gases above the piston. Support is lent to this theory by the facts that the greatest destruction took place around the base of one cylinder, and the the whole of the bottom of the crank case was shattered.

A. W. PURCHASE.

Oilfields, Calif.

The Briggs High Duty Miller

Special Correspondence

A single-purpose manufacturing miller of unusual design especially adapted for forming and gang-milling metal parts entering into the manufacture of small high-class work.

A manufacturing miller, built by Gooley & Edlund, Syracuse, N. Y., is shown in Figs. 1 and 2.

The designer of this machine is a manufacturing engineer who has felt the need of a miller better adapted for heavy and rapid cuts in manufacturing. His experience in this kind of work gave him a clear idea of just what features were most necessary for rapid and accurate production, and also just what complications, with their attendant weaknesses, could be eliminated.

With this object in view this single-purpose manufacturing miller was designed for form- and gang-milling steel parts entering into the manufacture of guns, automobiles, typewriters, sewing machines, etc. Rigidity, power and convenience of handling are the most necessary features for the rapid production of this class of work. The machine is a radical departure from the conventional miller

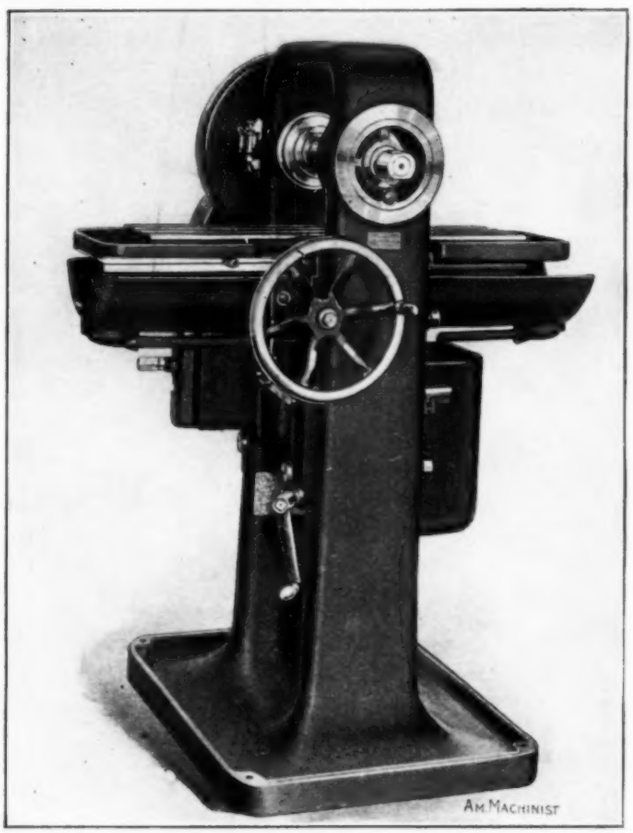


FIG. 1 FRONT AND SIDE VIEW OF BRIGGS' MILLER

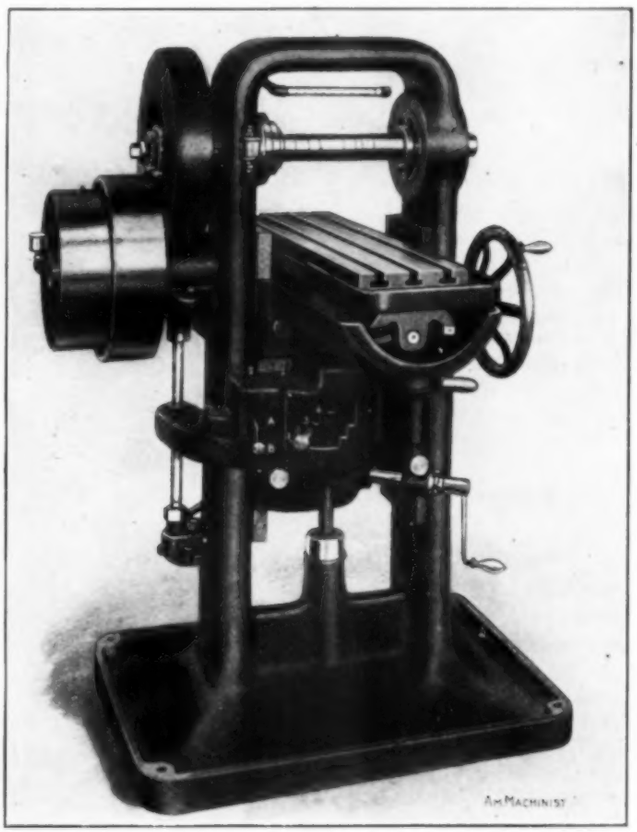


FIG. 2

THE FRAME

The frame of the machine is a single, arched casting with two uprights tied together, top and bottom, with no joints to spring and twist.

The inner faces of these uprights are provided with dovetailed ways, to both of which the heavy bed is fitted by scraping. Four 7/8-in. steel bolts pass through the bed and bed gibs and clamp the bed and uprights solidly together.

The upper part of the rear upright is bored for the spindle bearing. This bearing is adjustable for wear and provided with means for the efficient distribution of oil.

THE SPINDLE

The spindle is hardened and ground and is provided with Brown & Sharpe No. 11 taper. The arbor is held by a draw in bolt, and a threaded sleeve at the back end of the spindle facilitates the ejection of arbors. Side adjustment of the cutters is provided for by a bushing held and adjusted by opposed nuts, and driven by a key. The amount of side adjustment is 1/2 in.

OUTBOARD SUPPORT

The front upright is bored for a bushing 6 1/8 in. in diameter, supporting the adjustable sleeve bearing which acts as an outboard support for the spindle. This bushing is held in the upright by a single expanding bolt. When it is removed, arbors with cutters 6 in. in diameter may be passed through the hole in the frame. The arbors regularly furnished are 1 1/8 in. in diameter.

THE TABLE

Three lengths of table are regularly furnished—32, 38 and 44 in. in length by 10 1/8 in. wide. Their working surfaces are respectively 24, 30 and 36 in. by 8 in.

All tables have three 5/8-in. standard T-slots. The length of the automatic feed traverse for the various table lengths is 16, 22 and 28 in., respectively. The maximum distance from the center of the arbor to the surface of the table is 12 inches.

DRIVE

The drive is by a 3⅛-in. double belt. Four spindle speeds are provided from a two-speed countershaft to the two-speed cone shown in Fig. 1, the large step of which is 14 in. in diameter. The back-gear ratio is four to one.

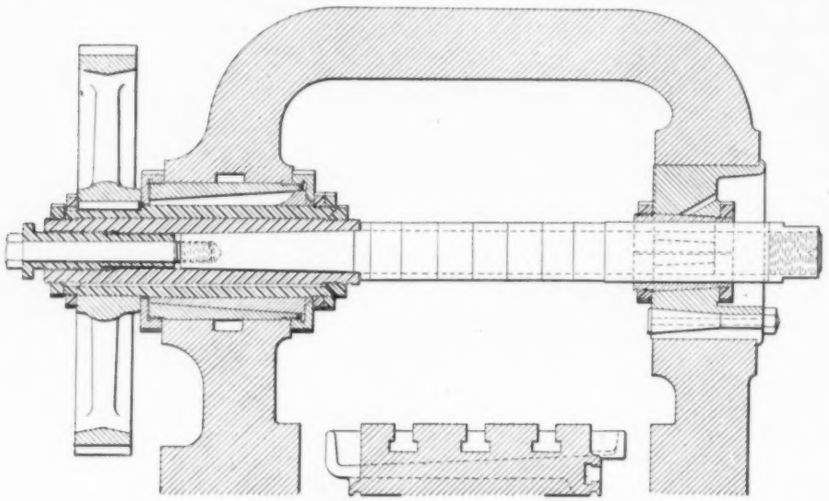


FIG. 3. SECTIONAL VIEW OF UPPER FRAME AND SPINDLE

FEED

The table has a screw feed and is provided with quick return by rack, pinion and handwheel, thus securing the advantage of the quick return of a rack-feed machine with the smoothness and rigidity of a power screw feed.

Eight gradations of feed are provided, ranging from 0.010 to 0.063 in. per turn of the spindle. The gears in the gearbox are all steel spur gears running in hardened bearings, the shifting gears are hardened. The feed nut has a hard bronze worm gear driven by a hardened steel worm.

A Steel Bar Milling Fixture

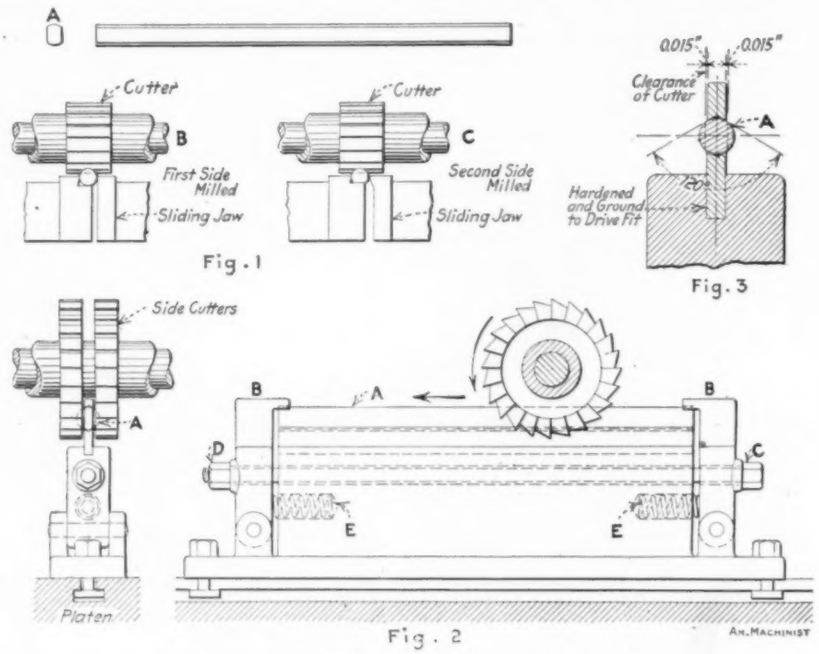
BY GEORGE G. LITTLE

A lot of ⅜-in. round cold-rolled steel bars 9 in. long were to be milled flat on two sides as at *A*, Fig. 1. The tools used for several years on this work were two pairs of vise jaws fitted to the regular miller vise, as shown at *B* and *C*, Fig. 1. The jaws *B* and *C* were for the first and second cuts respectively.

As the time required for this work seemed entirely out of proportion to the job, it was decided that some quicker way of removing the metal from the bars must be found. The cutter and feed had been speeded up to the limit, so nothing more could be done in that way to hasten the work.

After studying the work and tools a few days, a bar was clamped in position on the table of the miller so as to allow a pair of side milling cutters to pass from one end to the other and clear the clamps at the ends. All doubt as to this bar lying close to the support underneath was eliminated, and the work was then fed between the cutters, and the metal quickly removed, without any chattering whatever.

It was necessary to get a fixture to hold the bars for straddle milling, and as the new way proved best, at the experimental test, a fixture was designed and built as shown in Fig. 2. The bar *A* is shown clamped in position by the dogs *BB* at the ends, by means of the long bolt *C* passing through the dogs, the fixture body, and into the nut *D*. Two washers with one side convexed were provided for the bolt head and nut to swivel on, thus allowing the dogs to draw up freely.



A TIME-SAVING FIXTURE FOR MILLING STEEL BARS

A hole was drilled in either end of the fixture body for the springs *EE* which serve to open the dogs when the bolt releases them, thus allowing the bars to be easily placed in and taken out of the fixture. Suitable guide lugs were fitted to the underside of the body for aligning the fixture on the miller platen.

A detail of the clamping surfaces of the dogs and the V-block support is shown in Fig. 3. The V-block was hardened and ground to a driving fit in the fixture body. The V's were made 120 deg., and when the work was brought central with the cutters there was 0.015 in. clearance between the cutters and the sides of the dogs and V-block.

The work formerly required about ten days for milling both sides of 500 bars. After milling the bars were hand filed along the edges to remove the burrs thrown out by the cutter. The surfaces usually showed chatter marks and it was next to impossible to keep the sizes to within 0.001 in. of the dimensions shown on the shop drawings. When the new fixture was tried out on the next order of 500 bars, the work came from the machine with no burrs, no chatter marks, true to dimensions within 0.0005 in., and the entire 500 were milled complete in three days.

An international competition for power agricultural machinery is to be held in Uruguay, from May to October, 1912. It has been organized by the Rural Association of Uruguay, under the auspices of the Ministry of Industries, and will embrace seven classes: Steam plows, motor drag plows, harrows, cultivators, seeders and mowers.

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.

505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.

Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1911, 1,358,200 copies. For March, 1912 (American weekly, American monthly, English weekly and German weekly), total, 91,250.

Of this issue, 21,500.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 149

American Machinist

Machine Tools Defined as Machine-Building Machines

The question as to what machines properly come under the head of a "machine tool" still continues to vex builders and the custom officials. The logic of the case undoubtedly points to the tool used in the machine rather than the machine itself, but in the minds of mechanics generally, a "machine-building tool" would leave little doubt as to what was wanted.

Or, as framed into a definition by a well known builder, a machine tool, as usually understood, is "a machine primarily designed for making parts of other machines." This, for example, includes the engine lathe used for wood turning, as this is not its primary object, and excludes wood-working.

Any machine using tools to perform work is logically a machine tool, and "tool machine" as suggested by Charles E. Hildreth, is the more correct term. But while we are striving for a definition, it is really a classification we are after and this object seems to be attained if we think of them as "machine-building tools" or more properly "machine-building machines."

It would seem as though custom decisions might be more in accordance with the usual acceptance of the term if this designation were borne in mind.

What is a Draftsman?

With specialization comes the need of definition. Specialization is taking place in drafting rooms to a greater extent than we perhaps realize. In the designing offices of many large shops there are men who do nothing but figure stresses, others compute weights, others design springs, others handle specific machine details, and so on: In the nature of things this specialization will unquestionably continue.

Lest anyone should think that it is undesirable, we would point out that it is the inevitable trend of industry, and that in very many cases at least the men do not object to narrowing their work to a single line. But because of this very specialization, it becomes advisable to consider a definition of the draftsman. What is a draftsman?

We will probably get nearer to the truth if we confine our consideration to the personnel of a medium-sized drafting room, that is, to average conditions. Taking up the making of drawings and beginning with the less highly paid work and going upward, we find some men or boys who are tracing assemblies and details, other young men who are making detail drawings from assembly layouts, or building up assembly drawings from details that have already been completed, men who are laying out designs, and still others who are preparing the engineering data from which the designs are developed. We can accurately call these various men the tracers, draftsmen, designers and engineers.

It now remains to attempt to draw a line between the work of the designer and the draftsman on the one side, and the draftsman and the tracer on the other. The latter is probably not a difficult thing to do. The operation of tracing is perfectly well defined. We are justified in saying that the tracer is not a draftsman, although in a great many drawing rooms, particularly the small ones, the draftsmen do trace their own or other drawings. In some shops, tracing is done by girls.

The line between the designer and the draftsman can be drawn by considering that designing is a mental process and not a mechanical one. Designing is done in the brain. Of course, the development of a design upon paper aids the brain to carry on clear thinking and move from step to step in working out the scheme. Yet, the operation of designing is apart from the operation of making the drawing. One man has put it thus: "Designing is often done in the dark, during a sleepness night, or when one is a long distance away from a drawing board or piece of paper." On the other hand, drafting is a mechanical operation. It is making drawings. Primarily a draftsman must know how to draw.

Thus to draw the line between the work of the designer and the draftsman seems to place on one side the mental work of designing, and on the other the mechanical work of making drawings.

The accuracy of this classification is better seen when one considers the extent to which standard books of design are used in many drawing rooms. The laying out of a part then merely becomes the selection of standardized dimensions, contours, proportions and the like, and putting them together into a finished detailed part. This is clearly the work of a draftsman.

It is possible that many will think that we have unnecessarily restricted the application of the term "draftsman." To this charge we can only say that specialization implies narrow boundaries. In many shops, the men who are ordinarily called draftsmen do all the work which we have split up between the engineer, designer, draftsman and tracer. Such men are more properly engineers than draftsmen.

A Maximum Eight-Hour Bill for Government Work

A bill, having as its object the establishment of the eight-hour day on all work made for the Government, whether in government or private shops, is now before the Senate for consideration and action. The object of the bill is evidently to establish a government precedent for limiting working hours to eight per day, but, as is apt to be the case, the wording of the bill is open to more than one construction. It reads in part as follows:

> That every contract hereafter made to which the United States, or any territory, or the District of Columbia, is a party, and every such contract made for or on behalf of the United States, or any territory, which may require or involve the employment of laborers or mechanics, shall contain a provision that no laborer or mechanic doing any part of the work contemplated by the contract, in the employ of the contractor or any subcontractor contracting for any part of said work contemplated, shall be required or permitted to work more than eight hours in any one calendar day upon such work; and every such contract shall stipulate a penalty for

each violation of such provision in such contract of $5 for each laborer or mechanic for every calendar day in which he shall be required or permitted to labor more than eight hours upon said work.

The contractor is held responsible for all the subcontractors, and any violations of the law by the subcontractors require payment of the penalty by the chief contractor. The main difficulty in this respect is that it is not always possible for the contractor to know what is being done by the party to whom he sublets a portion of his contracts or, even if he attempts to enforce this, to collect the penalty from the subcontractors, as this, in the case of a small shop, might amount to as much as the value of the contract.

Section 2 of the act stipulates that it shall not apply to contracts for transportation by land or water, or for the transportation of intelligence, or for such materials or articles as may usually be bought in open market, except armor and armor plates, whether made to conform to particular specifications or not, or for the purchase of supplies by the government, whether manufactured to conform to particular specifications or not; provided that all classes of work which have been, are now, or may hereafter be performed by the government shall, when done by contract, by individual, firm or corporation, for or on behalf of the United States, be performed in accordance with the terms and provisions of the act.

This, however, may be waived by the President during time of war or when war is threatened. It also provides that no penalty shall be imposed for any violation of such provision, due to any emergency caused by fire, famine or flood, by danger to life or property, or by any other extraordinary event or condition, on account of which the President shall subsequently declare the violation to have been justifiable.

Although this might make the matter very flexible, many government contractors are at a loss to know how they shall provide against violation of this act in the case of articles which are not being made by the government at the time the contract is signed, and yet which may be made in government shops before the work is started or completed without their knowledge.

If fairly enforced, such a law puts all contractors on even terms, although it would not always be easy to so plan work as to put in eight hours on this work and the rest on regular work. In fact, it would probably be easier to run the shop only eight hours in the departments devoted to government work.

During 1909 there were 40,618 wage earners employed in the manufacture of brass and bronze products, according to a bulletin recently issued by the Census Bureau. This showed an increase of 49½ per cent. in the last ten years.

Mechanical Engineers to Honor Diesel

At a meeting of the American Society of Mechanical Engineers to be held on the evening of April 30, honorary membership will be conferred on Rudolph Diesel, director, Verein Deutscher Ingenieure, and inventor of the Diesel engine. It has also been arranged to have Dr. Diesel deliver, under the auspices of the Gas Power section, an illustrated address on his type of engine.

Marine Engineering Publications Consolidated

The Aldrich Publishing Co. has been organized to take over under one management the several engineering publications of Herbert A. Aldrich, which have hitherto been separate organizations. These publications include *International Marine Engineering*, which he founded fifteen years ago; also a publication of the same name which he established in London in 1906. Another one of the publications is *The Boiler Maker*.

The head offices of the new company will continue in the Whitehall Building, New York City.

New Publications

ENGINEERING AS A VOCATION. By Ernest McCullough. 201 5x8-in. pp. The David Williams Co., New York. Price, $1.

This book, by a thoroughly seasoned and competent engineer of wide experience and observation, presents an extremely readable and broad-gage view of the engineer and his work. It deserves to be read by every young man and by the parents of young men who contemplate for them the adoption of engineering as a vocation. Those who need it most and who will profit by it most are those who enter the profession not because of any love or fitness for it, but from the desire to enter a "learned profession" in which they imagine a genteel life and prosperity are secure.

We have seldom seen anything more informative than the chapters on the work and the education of an engineer; while the presentation of the seamy side of engineering in the chapter entitled "Does it Pay to Study Engineering?" will be an eye opener to those who enter engineering schools in the belief that they are entering on a highly paid profession.

It is scarcely too much to call this chapter pessimistic, although it must be said that the author, as a civil engineer, necessarily presents the observations and judgment of a civil engineer. At the same time it is true that his arraignment of the prevailing belief regarding the demand that exists for engineering graduates is sound and applies to all branches of engineering.

The book also contains a chapter on home-study courses, including work in the correspondence schools, and gives an excellent and well selected list of books for those who engage in home study, whose chief difficulty is always the selection of books, and especially the decision of the order in which they are to be taken up.

With the presentation of the difficulties and discouragements of the engineer's vocation is applicable to all branches of it, we consider that the uncertainty of employment, which is graphically set forth, is more acute among civil engineers than among others. The civil engineer has been defined as "the man who is always working himself out of a job"—a definition which can scarcely apply to other classes of engineers. With this exception, however, the presentation of the case is fair and adequate for the entire field of engineering, and a wide circulation of the book cannot fail to do much good.

Personal

Charles A. Secor, resident partner of Suffern & Son, will be in charge of his company's newly established branch office in Salt Lake City.

C. George von Rottweiler has been appointed chief engineer of the William Galloway Co., and factory manager of the Dart Manufacturing Co., Waterloo, Iowa.

Williard C. Brinton, until recently assistant vice-president of the U. S. Motor Co., New York City, has been appointed mechanical engineer of the Bush Terminal Co., New York.

R. S. Bryant has been appointed consulting engineer of the Standard Welding Co., Cleveland, Ohio. Mr. Bryant was formerly connected with the Bryant Rim Co., Columbus, Ohio.

E. F. Lake, who, until recently, conducted a consulting metallurgical business in Bayonne, N. J., has been placed in charge of the laboratory of the Perfection Spring Co., Cleveland, Ohio.

T. S. Bailey, who has been chief engineer of the New England Ship & Engineering Co., Groton, Conn., has accepted a position as Pacific Coast manager of the Electric Boat Co., with headquarters in Seattle, Wash.

Carl A. Smarling has severed his connection with the Locomobile Co., Bridgeport, Conn., where he acted as assistant chief tool designer, in order to accept a position as chief tool designer with the American Motors Co., Indianapolis, Ind.

Ernest L. Whiton, who has been identified with the office organization of the D. E. Whiton Machine Co., New London, Conn., for the past 26 years, has resigned to accept a position as treasurer of the newly organized New London Marine Iron Works.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

Heavy Forge Lathe

The lathe shown was recently designed by the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, for heavy reduction in rough-turning shafting and forgings.

The actual swing over the carriage is 15 in. and the swing over the bed 30½ in. The arrangement of spindle speeds is such that the lathe is adapted only for turning work between centers, that is, the speed range suits only diameters which will swing over the carriage. The spindle speeds regularly provide for turning at a rate not in excess of 140 ft. per minute on 3-in. diameters, and of not less than 61 ft. per minute on 15-in. diameters.

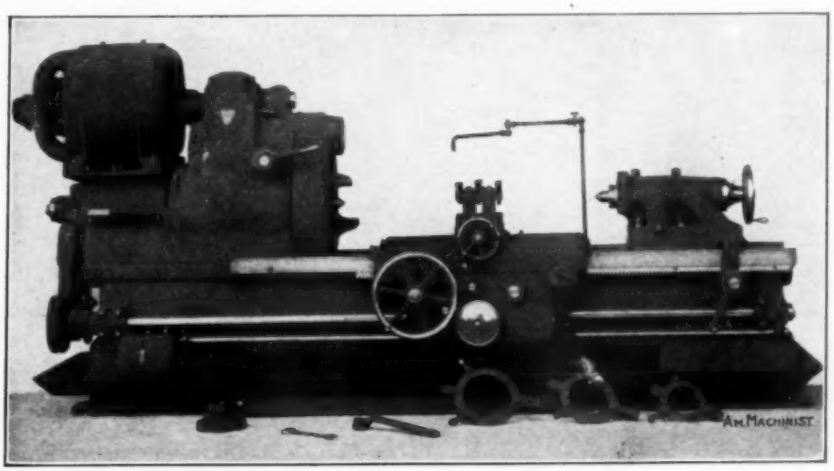


FIG. 1. HEAVY FORCE LATHE WITH MOTOR MOUNTED

The headstock is designed to receive a 30-hp. direct-current, variable-speed motor, having a speed range of from 400 to 1200 r.p.m., but any type of motor may be applied and also greater horsepower up to 40. There are two gear ratios, which with the motor range of 3 to 1 give spindle speeds from 15.6 to 173 r.p.m.

The driving gears within the headstock are of steel, hardened and heat treated. The lightest driving gear is 4 diametral pitch. The front spindle bearing is of large diameter and gives a projected area of 60 sq.in. The spindle takes a bearing in standard composition metal replaceable bearings. All other headstock journals are bronze bushed.

The back spindle bearing is also of large diameter and gives a projected area of 47 sq.in. The machine is provided with a compensating face-plate drive. The face-plate is 22 in. in diameter and is made of steel, as are the dogs which act as drivers. These drivers can be adjusted radially on the face-plate to accommodate driving dogs of various capacities and lengths.

The driving shafts within the headstock are supported on both sides of the gears, thus eliminating overhang. Forced lubrication is provided by pumped oil circulation for all of the driving gears, also for all of the journals, including the main spindle bearing and the thrust at the back of the spindle. The spindle is solid, and runs against a solid hardened steel plug at its back end to oppose the thrust of the spindle.

The oil drains from the headstock bearings and gearing to a reservoir cast in the bed underneath the headstock, and is pumped from this reservoir by a positively spiral-geared pump up to a reservoir at the top of the head, from which it is piped to the various bearings and gears. The centers are No. 6 Morse taper, and the one in the headstock is fitted into a hardened-steel bushing forced into the spindle.

The headstock is 48 in. long over all, and has the necessary gear covers to entirely inclose all the driving gearing. The machine will deliver, with a 30-hp. motor, about 19,500 lb. pull at an 8-in. diameter of shaft, and with a 30 per cent. overload of motor about 25,000 lb. This would ordinarily create a pressure of 400 lb. per sq.in. on the spindle bearing, but the driving pinion is so placed that the pressure of the cut is opposed by the driving pinion itself, consequently this amount of pressure per square inch is reduced.

The tailstock arbor is of large diameter and length, and is reamed for No. 6 Morse taper. It is made of tool steel. The tailstock has long bearing on the bed, and a locking pawl engages a rack cast inside the bed.

The carriage is gibbed both front and rear, and also under the inside V's. The tool block is steel, and rests on a cast-iron cross slide. It has one center slot to accommodate tools 1¼x2½ in., and two open sides for tools of the same dimensions.

The crossfeed screw is of large diameter, and is placed as high as possible to resist the action of the cut. There is an oil trough cast entirely around the carriage, and this is placed below the inverted dovetail so that the lubricant from the cutting tool will not flood around the sliding surfaces. The crossfeed-screw handwheel is 9 in. in diameter and equipped with two handles. A separate pump is provided for the cutting compound and is geared positively from the headstock.

The bed is mounted on cabinet legs, and has a heavy steel oil pan the entire length. The feed rod is of large diameter, and has two keyseats diametrically opposite for driving a steel bevel gear in the apron. The rod is driven by plain change gears, and four changes of feed are provided as follows: $\frac{1}{16}$, $\frac{3}{32}$, $\frac{5}{64}$ and $\frac{7}{64}$ in. per revolution. The feed gears are steel, of wide face and coarse pitch. The controller rod extends along the front of the bed, and is operated by a handle near the top of the carriage.

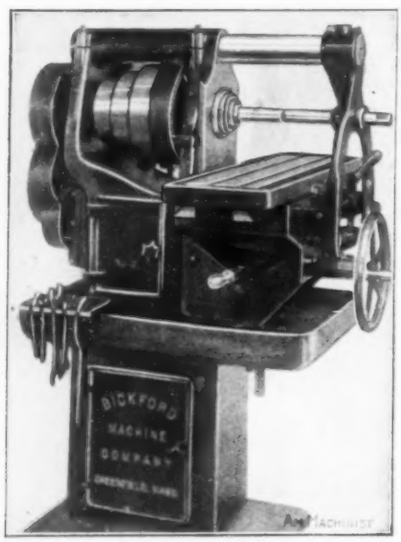
Plain Miller

The plain miller shown is a recent design of the Bickford Machine Co., Greenfield, Mass.

The knee and saddle are cast together solid, giving a table bearing 24 in. long by 8 in. wide. The feed is of the rack-and-pinion type, using a 6-pitch rack, 1⅜-in. face, and which may be of any desired length. By means of a special clutch and gear device inside the knee, the handwheel at the side of the machine is connected to operate either the knee up and down or the table in either direction, as desired. This is accomplished by a simple movement to the right

or left of the lever at the front and below the table.

The spindle is of crucible steel, and runs in phosphor-bronze bearings. The front bearing is bored with a taper hole to which the spindle is held from end motion by a special clamp collar. This bearing may be carried a distance of ¾ in. through the main housing, to which it is splined and held by a large nut at either end. The front end also carries a graduated collar, provided with a clamp



PLAIN MILLER

screw to set it back to zero from any position. The pulley runs free on the spindle and carries a gear driving the back shaft, and this, in turn, drives the main gear on the spindle, the power ratio being 6 to 1.

The feed is obtained by use of a coarse-pitch worm in mesh with a large gear on the pinion shaft, the end pressure of this worm being taken by a ball thrust bearing. This feed shaft is all gear driven, the feed changes being effected by opening a door in the front of the machine and shifting a lever. This gear box gives 10 different feeds for each of the three spindle speeds, or a total of 30 feed changes for the machine.

The pulley cones are 7½, 9 and 10¼ in. in diameter and carry a 2½-in. belt. The pulley is held to its position by a spring collar between one end and the main driving gear, which travels longitudinally with the spindle. The overhanging arm is of steel, 3¼ in. in diameter, and the drop arm and braces are cast solid.

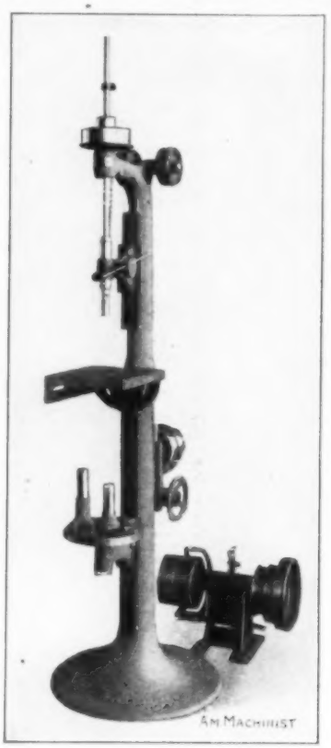
The table has two slots for T-bolts, and deep oil channel clear around the platen. The whole surface of the table is 10¼x 34 inches.

High Speed Drilling Machine

The halftone shows a 14-in. high-speed drilling machine, recently produced by the Washburn Shops of the Worcester Polytechnic Institute, Worcester, Mass.

The capacity of the machine is $\frac{15}{16}$-in. high-speed drills. All running pulleys have loose tobin-bronze bushings, and the spindle has a thrust bearing. The tension of the belts is controlled by automatically locked belt tighteners, by which the tension can be increased or decreased instantly, by turning the handwheel.

The spindle is graduated in inches and counterbalanced by a weight within the column. It has a 3-in. traverse and is adjustable 13½ in. vertically. The spindle-driving pulley is supported on an independent bearing. The bearing on which the spindle pulley runs is flooded with oil by means of a retaining ring cast concentric with the bearing, forming a basin which holds the oil and prevents spatter.



HIGH-SPEED DRILLING MACHINE

The machine has both a square and round table. The square table, which swings about the column, can be tilted to any angle. The round table has a vertical adjustment of 29 in. and can be removed, and a cup or crotch center placed in the supporting bracket. The height of the column is 6 ft. and the height of the machine with the spindle raised is 7 feet.

An Electric Hammer

The electric hammer shown herewith is of the inclosed construction, the frame forming a part of the tool casing.

The motor used is of the series type, and the brush holders are attached to the casing of the tool, so that the motor head may be readily removed. Ball bearings are used throughout, and the connecting rod which links the oscillating sleeve to the motor is a one-piece unit.

Within the sleeve is the hammer, made of hardened tool steel. Connection between the hammer and the sleeve is magnetic. The magnetism is furnished by the solenoid, which lies around the sleeve and provides a cushion.

The magnet is inoperative, so far as the delivery of the blow is concerned, acting merely as a flexible clutch to prevent the transmission of the strain and jar upon the gears and motor. The hammer delivers a blow of uniform force, whether running light or to full capacity,

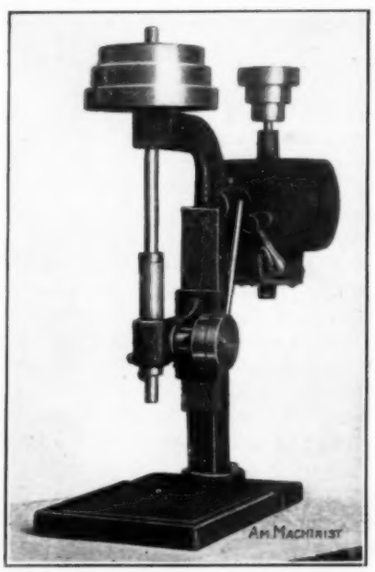
ELECTRIC HAMMER

and the operation is governed by a push switch located in the handle.

This hammer is made in several models by the Electro-Magnetic Tool Co., Chicago, Ill.

Motor Driven Sensitive Drilling Machine

The halftone shows a 12-in. sensitive drilling machine, motor driven, in which three changes of speed are provided.



MOTOR-DRIVEN DRILLING MACHINE

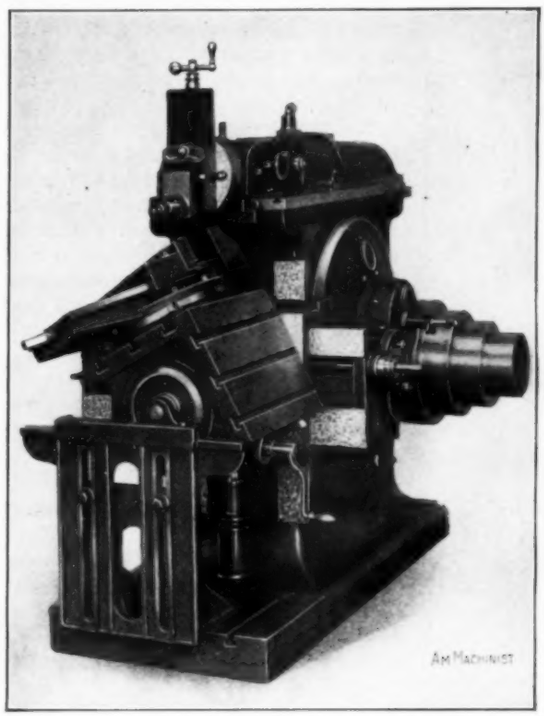
The spindle is counterbalanced by a coiled spring, and the sliding head has a travel of 8 in. The machine has a total height of 26 in., weighs 90 lb., and is a recent product of the Willey Machine Co., Jeffersonville, Ind.

Shaper with a Swiveling Knee

The special feature of the shaper here illustrated is the table support for the swiveling knee.

The knee is revolved by means of a worm and worm gear, operated by a handle conveniently located on the working side of the knee. A graduated dial reading to degrees on the front of the knee permits setting of the knee to any angle for planing bevels. One side of the knee can be furnished with a tilting top, making it possible to plane compound angles.

The machine is a 24-in. shaper, equipped as shown by the Stockbridge Machine Co., Worcester, Mass.



SHAPER WITH SWIVELING-TYPE KNEE

Threading Lathe

The machine shown is built up in the main like an ordinary engine lathe, having the regular back-geared headstock and divided tail block for setting over for taper. The spindle is hollow and provided with a draw-in collet attachment, the capacity of the largest collet being 1 in. The lathe swings 13 in. over the ways, 4 in. over the compound carriage and takes 28 in. between centers.

The lathe has a compound slide and double tool-holder which uses a roughing and finishing thread chaser. The chasers are fed in nearly to depth by means of the compound slide, obtaining an angular shear cut.

The lead-screw arrangement consists of a bracket mounted to slide to any position on the back slide of the lathe, and carries a lead screw of coarse pitch which, by means of a telescope shaft and gear, is driven from the lathe spindle at one of four different ratios as follows: 1 to 1, 1 to 2, 1 to 3, or 1 to 4.

The carriage is so divided that the upper part slides across the lathe and carries a half-nut into mesh with the lead screw. The lead-screw thread is of the buttress form, and the operating lever throws to a dead-center position, so that a tendency to crowd the cutting tool away from the work is avoided. The lead screw carries a clutch dog at one end and is easily removed, as is also the nut.

The special feature of the design is to save the time of running the lathe back in the thread of the lead screw, and the compound slide to facilitate lining up to a thread already partly cut.

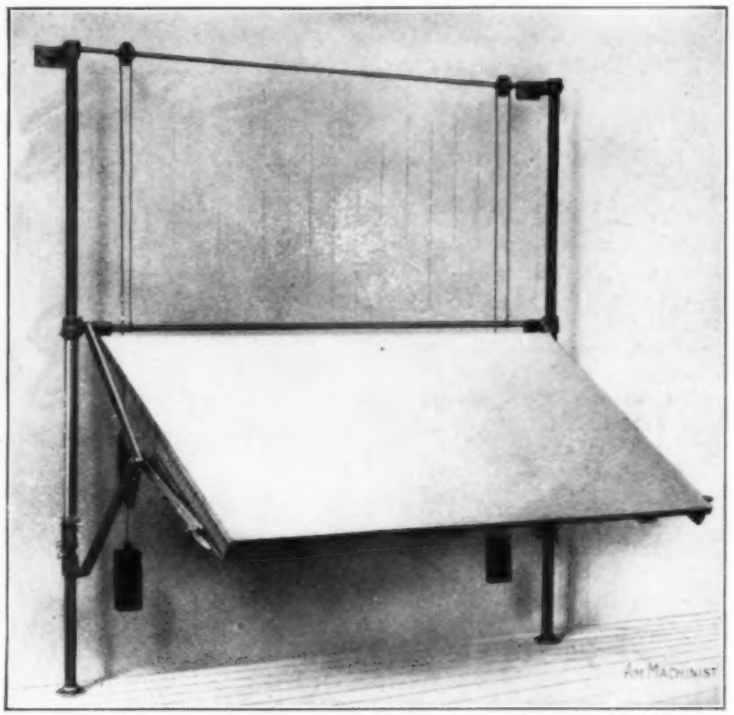
Wall Layout Drawing Board

The design and construction of the drawing board shown herewith, is readily noted from the halftone.

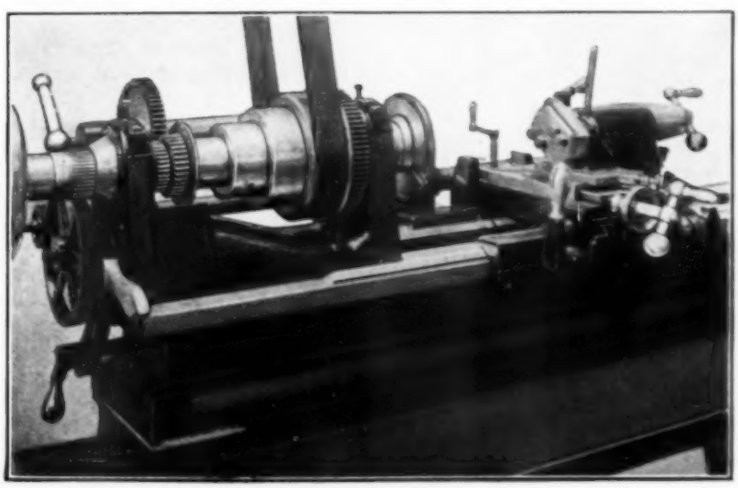
It can be used in a vertical or horizontal position. When used vertically the bottom can be adjusted from 12 to 36 in. from the floor, which brings the top within easy reach. In this position it takes up only about 8 in. from the wall. When used horizontally it can be adjusted from 36 in. to 84 in. high. At this height it leaves head room and can be used as a shelf for files, etc.

Any angle can be obtained between horizontal and 45 deg. by releasing the lock pin with the hand lever at either side.

This board is made by the American Drafting Furniture Co., Rochester, N. Y.



WALL LAYOUT DRAWING BOARD



THREADING LATHE

Loose Pulley Oiler

The illustration shows a simple form of loose-pulley oiler, recently designed by the Butler Chuck Co., Greenfield, Mass. It consists of a brass tube closed at

LOOSE-PULLEY OILER

one end, and a wooden plug, with a small hole in it, inserted in the other end. The plug has a coiled spring attached, which extends the length of the tube.

In use, the tube is filled with oil, and the taper end of the plug placed in the oil hole of the loose pulley. The spring exerts sufficient tension to keep the oiler in place between the hub and the rim.

The oilers are made in a variety of sizes.

Double Draw Presses

The double-draw presses illustrated are two of a line of six sizes recently built by the E. W. Bliss Co., Brooklyn, N. Y.

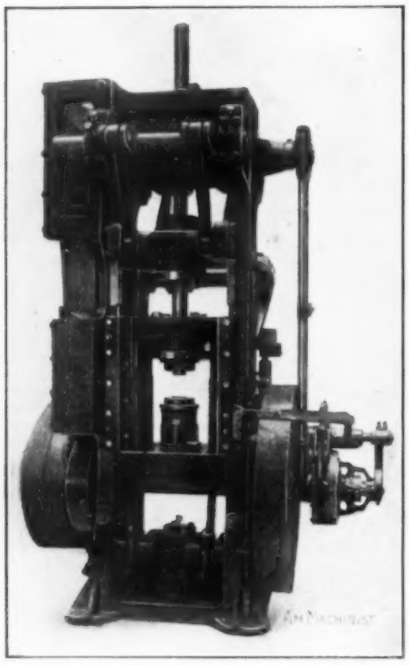


FIG. 1. DOUBLE-DRAW PRESS FOR BLANKS UP TO 12 INCHES

The machines draw 1X tin to $\frac{1}{10}$-in. steel blanks up to 25 in. in diameter, and produce shells up to 10 in. in depth. The smaller sizes are of a somewhat different construction, being adapted to permit the use of dies with cutting edges, in order to cut blanks, draw and redraw in one stroke. The larger sizes, beyond 12 in. in diameter blank capacity are not adapted for the use of dies with cutting edges.

The slide movements in these presses are made to operate the dies as follows: A double die is brought, with the blank on its top, in contact with a blank-holder, a tubular punch then descends into the top section of the die, making the first draw. The tubular punch then stops, and

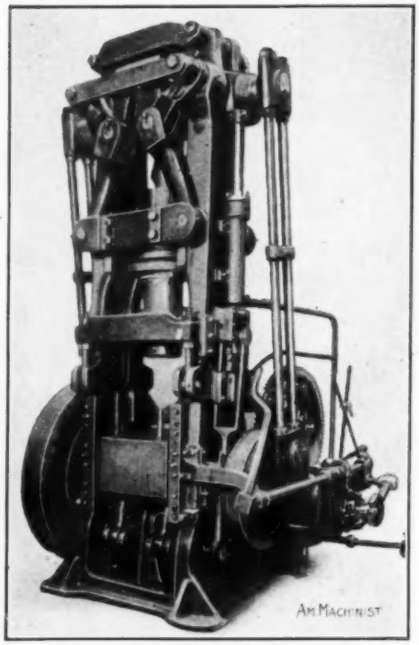


FIG. 2. DOUBLE-DRAW PRESS FOR BLANKS UP TO 21 INCHES

dwells, acting as a blank-holder during the second draw. This second draw is performed by a punch that descends through the tubular punch into the lower section of the die, beginning the second draw immediately after the first is completed.

The machine shown in Fig. 1 is used for cutting blanks up to 12 in. diameter from brass sheets or strips up to No. 22 gage, and performing two draws on them. In this machine the die bed is fixed and rigid and the blank-holder, carrying the top cutting edges, has motion in long adjustable guides. The moving parts are mechanically balanced as far as possible and are started and stopped automatically or by hand by means of a combined toggle friction clutch and brake.

The blank-holder is actuated by toggles that receive motion from a cam, the toggles produce a blank-holder dwell during the drawing period and receive the blank-holder pressure, relieving the cam of pressure during that time. The first draw-punch slide is actuated by a crank-and-toggle motion and the second draw punch by a simple crank motion.

The machine shown in Fig. 2 receives steel blanks up to 21 in. in diameter and to No. 20 gage. It will receive first draw punches up to 14 in. in diameter and produce shells up to 8 in. final depth.

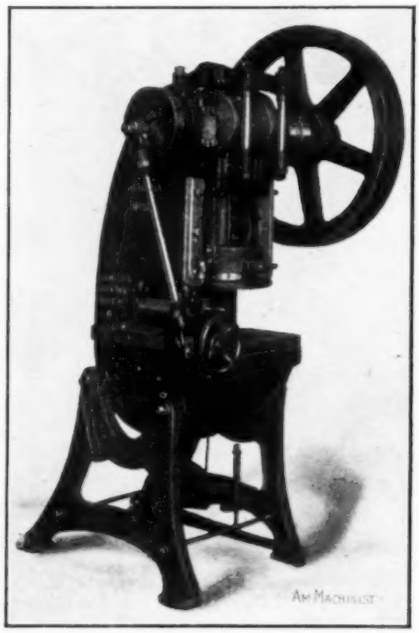
In this machine the lower dies are fastened to a table that has motion and are brought up against a stationary adjustable blank-holder. The table is moved up and down by toggles actuated by a large cam groove in the main gear. The toggles take all the pressure due to the blank-holder and the descent of the punches, and so relieve the cam of any duty other than moving the table up and down. As the table is counterbalanced, its work is light.

The first draw-punch slide receives its motion through toggles from the second draw-punch slide, the toggles providing a fine dwell for the first draw punch during the drawing period of the second punch. All the moving parts are counterbalanced during their up and down movements by a hydraulic plunger and accumulator system, rendering the starting of the press easy and certain.

The hydraulic accumulator can be placed wherever most convenient. Part of the piping for the accumulator is shown. The machine is driven and controlled by means of a combined friction clutch and brake fitted with both hand and automatic control.

Double-Action Cam Press

The halftone shows a double-action cam press, recently developed by the Niagara Machine & Tool Works, Buffalo, N. Y.



DOUBLE-ACTION CAM PRESS

A threaded sleeve is used on the lower end of the blank-holder slide, by means of which the adjustment can be readily and accurately made. Owing to this ar-

rangement, it was made possible to bring the guides for the blank-holder slide directly in line with the center of the crankshaft. Adjustable gibs are provided, not only for the blank-holder slide, but also for the inner slide.

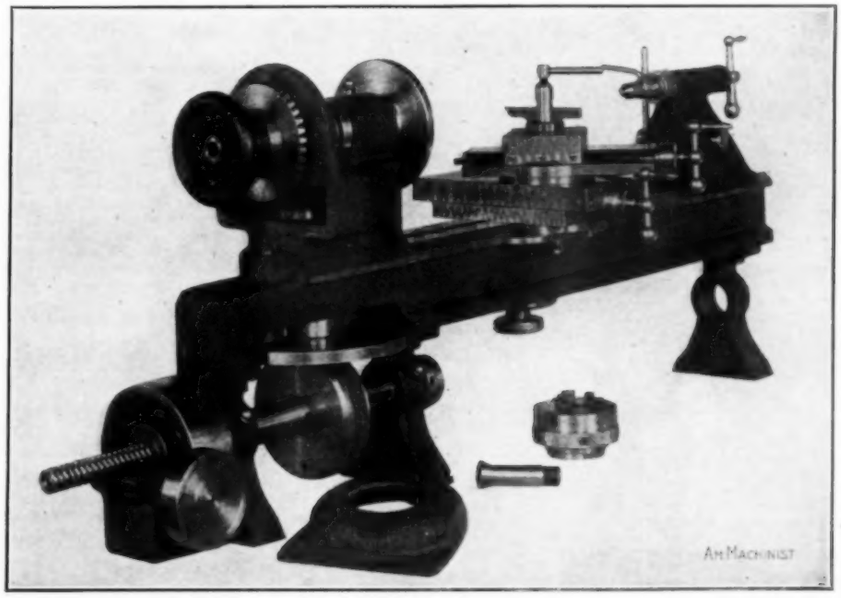
The outer slide, or blank holder, is positive in its motion, and is raised and lowered by two cams, keyed to the mainshaft, alongside of the crank. The camroller yokes are rigidly connected with the blank holder, and provision is made to take up wear. The lower cam rollers are set in oil boxes to insure proper lubrication for rollers and cams. The inner slide receives its motion from the crankshaft, by means of a pitman, which has vertical adjustment.

Precision Bench Lathe with Friction Drive

The halftone shows an 8-in. friction-driven precision bench lathe, the drive consisting of a single continuous-speed pulley, thus eliminating cone pulley and belt.

The transmission of the power from the driven friction disk to the spindle is by means of the miter gears shown. These gears run in oil and are keyed to the friction-disk shaft and spindle shaft, respectively. Ball-thrust collar bearings are interposed between the disk and the lathe bed.

As will be seen, a constand-speed pulley of sufficiently wide face and diameter is employed to secure ample belt power.



PRECISION BENCH LATHE WITH FRICTION DRIVE

The driving pulley is keyed to a hollow slotted driving shaft, which contains a rack shaft. A common driving key passes through both shaft members and is inclosed in the driving friction wheel. The rack shaft meshes with a pinion wheel, which is attached to a handwheel, on the outer edge of which is a speed indicator.

By means of the handwheel, the friction driving wheel is shifted on the friction disk, the driving key sliding in the slot of the driving shaft to any desired speed or reverse. By means of a depression in the center of the friction disk, the machine can be stopped almost instantaneously, independently of the driving belt.

Wear on the friction driving material is provided for by means of eccentric bushings, so arranged that the friction wheel and driving shaft may be raised or lowered parallel to the friction disk.

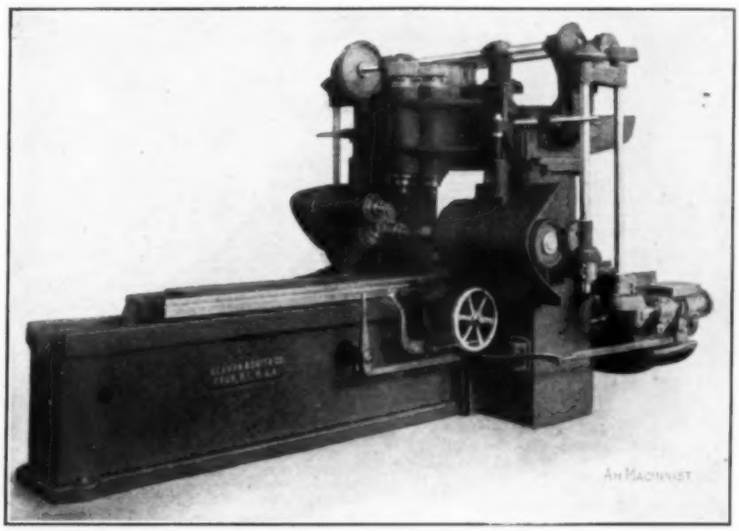
The machine is a recent development of the Cincinnati Precision Lathe Co., Cincinnati, Ohio.

A Nine-Spindle Miller

The nine-spindle miller shown, is designed to finish in one operation three sides of as many T-head cylinder castings as the table will accommodate.

The machine consists of a bed supporting a work table. To the bed are attached two uprights, which in turn carry a crossrail. On the crossrail is a saddle carrying three vertical spindles. The saddles have a vertical and horizontal movement on the uprights and crossrail, respectively.

The table has a work surface 17 in. by 10 ft., with three T-slots finished from the solid; it has a movement of 10 ft. 10 in. on the bed, and is provided with a quick power movement of 3½ to 14½ ft. per minute, in either direction. Automatic stop and feeds are provided and so arranged as to maintain the desired rate at any spindle speed. The table is operated by a screw in a revolving bronze nut, the thrust being taken by ball bearings.



NINE-SPINDLE MILLER

The feeds for the table are positive in either direction by means of gearing contained in a feed box conveniently located. There are nine changes, and feeds from 1 to 6 in. can be had at any spindle speed.

The spindles are of crucible steel, running in hard-bronze boxes. The 45-deg. spindle has 2-in. endwise adjustment, all others have 1½-in. The front bearings are 3 in. in diameter and 4 in. long. Means are provided to compensate for wear. The rear bearings are 2½ in. in diameter and 4½ in. long. The speeds vary from 17 to 69 revolutions per minute.

This machine is driven by a 7½-hp. motor, 400 to 1600 r.p.m., through gearing in the ratio of 23 to 1. The distance between uprights is 31 in. from end of the vertical spindles to the top of the table. The machine weighs 20,000 pounds. It is a recent design of the Beaman & Smith Co., Providence, R. I.

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

Metal Working

NEW ENGLAND

The type foundry of H. C. Hansen, on Congress St., Boston, Mass., was damaged to the extent of $50,000, by fire, on Apr. 9.

The Harrison Square Foundry Co. will erect a foundry on Gibson St., Dorchester District, Boston, Mass. G. H. Carson is president.

The Johnson Steel Wheel Corporation, Boston, Mass., has been organized and will erect a factory at South Boston, Mass., to manufacture a patented steel wheel for motor trucks.

W. H. Marble, Brockton, Mass., is planning to construct a two-story addition to his garage, which will more than double its present space.

The Wells Bros. Co. and Wiley & Russell Mfg. Co., manufacturers of taps and dies, both of Greenfield, Mass., have consolidated. Extensive improvements will be made.

J. N. A. Langevin, Southbridge, Mass., will install a machine shop and power plant in connection with his garage on Main St.

Gagnier & Angers have the contract and have started work on a new garage at 521 Worthington St., Springfield, Mass., for George Smith. It will be 46x103 ft., two stories and basement, of brick. H. L. Sprague is architect.

The contract will be let at once for the new foundry on Water St., to be erected for the Belknap Mfg. Co., Bridgeport, Conn. It will be one story, 131x48 ft., of brick and steel. The Fletcher Engineering Co. is architect.

Work will soon be started on a new plant on Connecticut Ave., Bridgeport, Conn., for the United Foundry & Machine Co. The plant will cover a plot about 100x190 ft., and will consist of a machine shop, power plant and foundry buildings. William C. Buckelew is president.

Plans are being figured for the erection of three new factory buildings on Washington Ave., Waterbury, Conn., at the plant of the Waterbury Brass Corporation, for the American Brass Co. The largest building will be 42x152 ft., four stories high, and the others will be 42x57 ft., three stories high, and 42x50 ft., one story high, all of brick and steel, mill construction.

Griggs & Hunt, architects, are completing plans for the new factory building to be erected on South Main St., Waterbury, for the Waterbury Buckle Co. It will be 58x123 ft., three stories and basement, of brick, mill construction. Noted Apr. 11.

MIDDLE ATLANTIC STATES

The Deyo-Macey Engine Co., Binghamton, N. Y., will erect a new plant.

The Buffalo Tool & Supply Co., Buffalo, N. Y., will build an addition to its plant, on Henry St.

Fire caused about $10,000 damage to the plant of the Buffalo Foundry & Machine Co., Buffalo, N. Y.

The Hoefler Ice Cream Co., Buffalo, N. Y., will erect a three-story garage at an estimated cost of $50,000.

The Electric City Mfg. Co., Buffalo, N. Y., has moved to a three-story brick factory building on Adams St., near William St., and will equip for a general stamping business in sheet metals.

J. W. McDermott, 75 Macon St., Brooklyn, N. Y., has obtained a permit for the construction of a one-story brick garage.

The Starr-Giles Mfg. Co., Elmira Heights, N. Y., will be in the market soon for a few tools, such as a small machine, shaper and cutoff tool, as well as different sizes of steel.

Work has commenced on the new cement addition to the Williams Garage, Newton Boulevard, Freeport, L. I., N. Y. The building will be 40x60 ft.

V. de P. Goodwin has leased the two-story building at 207 West 75th St., New York, N. Y., and will remodel it for use as a garage.

The Dyneto Electric Co., manufacturing lighting devices for automobiles and motor boats, will remove its plant from Elbridge, N. Y., to Syracuse, N. Y.

Cronk Bros., Utica, N. Y., manufacturers of electric motors, will erect an addition to their factory.

The Erie Saw Co., Erie, Penn., has been incorporated by W. C. Kreamer and Nelisen and Louis Streuber, and and will erect a plant for the manufacture of saws and tools for butchers' and grocers' use. Capital stock, $10,000.

The Aluminum Co. of America has completed plans for the erection of two large mills at New Kensington, Penn.

Work was commenced, Apr. 12, by William Steele & Sons' Co., on the stove foundry buildings to be erected at Erie Ave. and Sepviva St., for Isaac A. Sheppard & Co. The work includes a one-story boiler house, 67x67 ft.; a two-story light manufacturing building, 74x34 ft.; a two-story manufacturing building, 142x44 ft. 2 in., and a one-story garage, 58x33 ft. 2 in. The cost will be $42,000.

The C. H. Weiler Mfg. Co., Philadelphia, Penn., has awarded the contract for the construction of a one-story machine shop, 125x213 ft., and a boiler house, 20x54 ft., at Lehigh and Sedgley Aves. The estimated cost is $65,000.

The Valley Mould & Iron Co., Pittsburg, Penn., is planning the construction of a large addition to its plant. The new building will cover the vacant property between the present plant and the Alice Blast Furnace Co.

S. F. Eisenbrower, Reading, Penn., has secured a permit to build a one-story, 50x80-ft. garage on Lincoln St., between Douglass and Winssor Sts.

Permits have been granted to H. W. Poettiger, 200 West Oley St., and Nicholas Stengel, 317 North Ninth St., Reading, Penn., for the construction of two one-story garages.

The contract for the erection of a large steel car shop for the Harlan & Hollingsworth Corporation, Wilmington, Del., has been awarded.

The Jones Hollowware Co., Baltimore, Md., has purchased a large foundry in that city, and will build an addition to it.

Bids are asked until 10:30 a.m., Apr. 29, by Maj. F. C. Boggs, corps of engineers, U. S. A., general purchasing officer, Isthmian Canal Commission, Washington, D. C., for furnishing the following materials: Circular 704, Class 1, 300 couplers, complete; Class 2, Item 2, 15,000 ft. black wrought-iron or steel pipe, standard, 12,000 ft. ¾-in., 5000 ft. 4-in.; Class 3, Item 4, 1500 ft. soil pipe, single hub, 4-in.; Item 5, soil pipe, double hub, 300 ft. 2-in., 600 ft. 4-in.; Class 4, 88 lengths 8-in. cast-iron pipe, with fittings, lengths 12 ft., or less. The remaining classes cover small quantities of lead gaskets, gate valves, fire hydrants, asbestos and rubber gaskets, hammers, etc.

Bids are asked as follows, until 10:30 a.m., May 1, by Maj. F. C. Boggs, general purchasing officer, Isthmian Canal Commission, Washington, D. C., under Circular 703: 3300 cast-iron car wheels, 665 lb., 33-in.; 500 615 lb., 22-in., and 100 500 lb., 30-in., to be delivered during the year ending June 30, 1913.

Bids are asked as follows, until 10 a.m., May 7, by the Paymaster-General, U. S. N., Chief of the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for the following materials: Schedule 4474, for delivery at Norfolk Navy Yard, Class 54, one electric driven winch, capable of maintaining a pull of 1600 lb. at 200 ft. per minute. Schedule 4481, Class 121, for delivery at Boston, Mass., 7000 lb. crucible cast-steel wire, galvanized, annealed; Class 122, for delivery at Puget Sound navy yard, 15,880 lb. wire rope, plow steel, ungalvanized, 6-strand, 19 wires to the strand, diameters, ⅝ to 1⅜ in.; Class 123, for delivery at Brooklyn navy yard, 53 steel springs, and 18 phosphor-bronze springs; Class 124, for delivery at Puget Sound navy yard, 12 direct differential blocks, one-ton, and six spur-geared chain hoists, one ton. Schedule 4485, for delivery at the Newport News Shipbuilding & Dry Dock Co., and the Maryland Steel Co.'s works, Class 155, eight metallic life rafts and two to the U. S. S. Collier Jupiter, Mare Island navy yard. Schedule 4486, Class 156, for delivery at Norfolk navy yard, one type F. C. 204 high-speed steel furnace with transformer, for 220-volt, 60-cycle current, complete with all accessories, one recalescent outfit, and one preheating furnace. Schedule 4487, Class 162, for delivery at Mare Island navy yard, air hoists, one 2½-ton and one 5-ton.

SOUTHERN STATES

The Emerson Engine Co., Alexandria, Va., will start work soon on the erection of its plant.

The Staunton Motor Co., Inc., will remodel the two-story building, 50x70 ft., on South New St., Staunton, Va. A vulcanizing plant will be installed in addition to a repair shop and sales room.

A garage is being erected on the South Side, Wheeling, W. Va., by the Kloss Ice Cream Co.

Bids for the construction of a garage will be opened about Aug. 1, by the American Motor Co., Greensboro, N. C.

The Marion Mfg. Co., Marion, N. C., will spend $500,000 to enlarge its plant. J. E. Sirrine is the architect-engineer.

The Carolina Cadillac Co., Winston-Salem, N. C., has established a branch at Raleigh, N. C., on Fayettesville St. The company contemplates the construction of a new building at Raleigh. C. E. Enfield is in charge.

A new garage will be constructed at Charlerol, S. C., by C. S. Van Voorhis and L. R. Kinder.

The Van Winkle Gin & Machine Co., Atlanta, Ga., has disposed of its machinery plant and plans are being prepared for a new factory for the manufacture of motor trucks.

Jesse H. Hall, Cherry St., Macon, Ga., has awarded the contract to erect a second story on garage recently built, 50x150 ft., mill construction.

J. B. Wofford is constructing a concrete garage, Miami, Fla.

S. L. Pemberton will erect a one-story garage at Oak and Nebraska Aves., Tampa, Fla., to cost $2500, and will equip with drills, lathes, etc.

Fire originating in the oil mill of the Evergreen Mfg. Co., Evergreen, Ala., on Apr. 8, destroyed the entire plant. Loss, $30,000.

The city of McRae, Ala., will erect a modern machine shop. W. S. Jessup is city engineer.

Jean H. Duffy has leased the building at 820-4 Julia St., New Orleans, La., and will remodel and equip for automobile repairing and enameling factory.

H. Nyberg, president of the Nyberg Automobile Works, Anderson, Ind., has organized an automobile company, at Chattanooga, Tenn., and will erect a plant for the manufacture of motor cars.

MIDDLE WEST

The McMyler-Interstate Co., Cleveland, Ohio, manufacturer of all kinds of hoists and conveying machinery, have issued bonds for $500,000, the proceeds to be used for more working capital and mechanical equipment for plant.

The Cleveland (Ohio) Bronze & Brass Works, manufacturer of brass castings and brass finishers, will erect a $60,000 plant.

The William Chisholms' Sons Co., Cleveland, Ohio, manufacturer of steel shovels, will enlarge its plant.

The Militaire Auto Co., Cleveland, Ohio, will soon equip a factory for the manufacture of a combined auto and motorcycle.

The four-story factory of the Elgin Brass Co., Cleveland, Ohio, founder and brass finisher, was destroyed by fire.

The A. R. Davis Motor Co., Cleveland, Ohio, has awarded the contract for a large addition to its repair shops at 2634-6 Euclid Ave.

The Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, has awarded the contract for a new 32x160-ft., one-story, brick and steel structure. G. W. Drach, 1701 Union Trust Bldg., Cincinnati, is the architect.

The Victor Safe & Lock Co., South Norwood, Cincinnati, Ohio, is planning to erect a two-story addition, 100x300 ft., on Cleneay Ave.

Fire destroyed the plant of the Barker Machine & Tool Co., and the American Laundry Co., at Pioneer and Culvert Sts., Cincinnati, Ohio, causing a loss of $50,000.

The Columbus Auto Brass Co., Columbus, Ohio, has let a contract for the erection of a two-story factory building on North Fourth St. Noted Feb. 29.

The Lauth-Juergens Motor Car Co., Fremont, Ohio, will construct a one-story brick and steel addition, 60x200 ft., to its plant.

The Buckey Aluminum Co., Wooster, Ohio, maker of aluminum castings, has raised its capital to $150,000 and will buy equipment for enlarged plant.

The Valley-Mould & Iron Co., Youngstown, Ohio, has awarded the contract for the erection of a large addition to its plant at Sharpsville, Ohio.

The Shirley Radiator Co., Shirley, Ind., which was recently destroyed by fire, will erect a plant at Beech Grove, Ind.

The Ore Iron Co., Evansville, Ind., will erect a four-story plant, on Walker St., to cost $50,000.

The Gary Bolt & Screw Co., Gary, Ind., will build a $1,000,000 plant. John A. Collins is manager.

The American Motors Co., Indianapolis, Ind., manufacturer of the American automobile, will erect an additional three-story factory building at Meridian St. and Belt Ry. tracks. It will be of steel, concrete construction and will cost $12,000.

The Standard Chain Co., Marion, Ind., will expend $50,000 in enlarging its factory.

J. C. Llewellyn, 38 South Dearborn St., Chicago, Ill., is preparing plans for a four-story foundry and pattern shop, 50x100 ft., for the Union Steam Pump Co., Battle Creek, Mich., to cost about $50,000.

The Cole Motor Car Co., Indianapolis, Ind., will establish a branch at Willis and Woodward Aves., Detroit, Mich., where a building, 40x75 ft., is being erected.

The R. C. Hupp Co., Fort St. and Lycaste Ave., Detroit, Mich., has awarded the contract for the one-story and basement automobile factory, 402x260 ft. The estimated cost is $75,000.

The Michigan Stamping Co., Detroit, Mich., manufacturer of stamped parts for automobiles, is erecting a new factory.

The Murphy Iron Works, Detroit, Mich., is erecting a new foundry.

The Wagenthals Motor Car Co., Detroit, Mich., recently organized, has completed plans for a factory for the manufacture of automobile delivery cars.

Fire damaged the hardening room of the Gemmer Mfg. Co., at 741 Merrick Ave., Detroit, Mich., on Apr. 9. Loss, $2000.

The Murphy-Potter Co., Detroit, Mich., will construct a new plant, for the manufacture of brass specialties and automobile parts. Some power-transmission machinery and machine tools for brass working will be purchased.

The Swedish Crucible Steel Co., Hamtramck, Mich., manufacturer of steel castings, is erecting a new factory.

The Ideal Gas Engine Co., Lansing, Mich., is having plans prepared for a one-story factory, 40x300 ft., and 82x301 ft. The estimated cost is $100,000.

The Wyandotte Foundry Co., Wyandotte, Mich., whose plant was recently destroyed by fire, is erecting a new plant, and entire new equipment will be needed.

The Pintsch Compressing Co., Sault Ste. Marie, Mich., will erect a new plant.

The Havana Metal Wheel Co., Bloomington, Ill., are erecting the building which was damaged by fire in January. It will be of fireproof construction.

Walashek & Cvencik, Chicago, Ill., are erecting a $7600 garage, at 3818-22 West Twelfth St.

Hugh J. MacHugh, Chicago, Ill., will build a $5500 repair garage, at 7604-6 South Hulsted St.

Fire caused a $12,000 damage to the garage of Clifford M. Leonard, at 1346 La Salle Ave., Chicago, Ill.

Fire partly destroyed the building occupied by Beckley-Ralston Automobile Supply Co., 1428 Michigan Ave., Chicago, Ill., on Apr. 8.

The Inland Steel Mill, East Chicago, Ill., has started to build a plate mill.

Gustafson & Scott, Chicago, Ill., will build a one-story machine shop, 39x125 ft., at 1655 Lowell Ave., to cost $4500.

The Vesta Accumulator Co., Chicago, Ill., will erect a three-story, mill construction, building 100x161 ft., at Indiana Ave. and Twenty-first St., to cost $80,000.

The United States Radiator Corporation will add to its foundry, at Edwardsville, Ill., a new frame building, 135x200 ft. New foundry and core-room equipment will be needed.

A. J. Criner, Burlington, Ill., will establish an engine factory, at Nauvoo, Ill.

The International Hoist Co., Antigo, Wis., will start work immediately on the erection of two new buildings. The main building will be 40x80 ft., and the foundry, 60x90 ft.

Fairbanks, Morse & Co., Chicago, Ill., are constructing an 80x130-ft. extension to their Eclipse Works, Beloit, Wis.

Philbrick & Mather, Baraboo, Wis., are erecting a fireproof garage building.

The Aluminus Castings Co., Manitowoc, Wis., will start work at once on its concrete and steel addition, 120x420 ft.

Fire in the foundry department of the engine plant of the Termaat & Monahan Co., at Oshkosh, Wis., caused a loss of $8000, Apr. 8.

The Case Threshing Machine Co., Racine, Wis., has started work on a $1,000,000 foundry, at Lakeside, which will be used in the manufacture of gas farm tractors.

Barlon & Seelig, Ripon, Wis., manufacturers of electric washing machines, will erect a plant, 60x40 ft., with latest equipment. A complete wood-working plant will be installed.

WEST OF THE MISSISSIPPI

The H. J. Frank Foundry Co., Davenport, Iowa, will build a foundry to cost about $11,000. The contract has been awarded.

The A. E. Shorthill Steel & Iron Works, Marshalltown, Iowa, is erecting a new plant at Perry, Iowa, and will move to that city.

The Chicago, Milwaukee & St. Paul R.R. Co. will build a roundhouse at Aberdeen, S. D. The estimated cost is $75,000.

Lyons & Co., Grand Forks, N. D., have awarded the contract for the erection of a brick and concrete garage and repair shop on North Fourth St. The estimated cost is $8000.

Fire in the garage of the Montana Motor Car Co., Great Falls, Mont., caused a loss of $46,500, Apr. 5.

Plans are being prepared for the construction of a garage at Pulaski Heights, Ark., for Moorhead Wright, Little Rock, Ark. The estimated cost is $12,000.

The A. B. Dozier Co., Taylor, Tex., will erect a large garage on South Porter St. The contract has been awarded.

T. F. Stroud & Co., Omaha, Neb., whose works were recently destroyed by fire, will immediately commence the erection of one of the largest plants in the West, and will be in the market for modern iron and wood-working machinery, wagon making machinery, machine tools, labor-saving appliances, including five-ton electric crane suitable for central bay of 30-ft. span, water tank and towers, automatic and sprinkler system. The company also invites proposals from manufacturers of oil-burning steam boilers. Second-hand tools will be considered if in first-class condition.

Dr. J. W. Howell Bryan, Tex., plans to build a garage on Main St., to be occupied by Johnson & Rhode.

E. A. Crow, Cleburne, Tex., will erect a fireproof garage, 45x105 ft. Contract has been awarded.

E. E. Evans, Mercedes, Tex., will construct a garage and machine shop, at Ohio Ave. and Fourth St.

WESTERN STATES

Jensen & Muzzy, Payette, Idaho, will soon erect an addition to their machine shop to be used as a brass and iron foundry.

The contracts have been awarded for the construction of a new roundhouse and shops for the Northern Pacific Ry. Co., at Centralia, Wash.

E. C. Roe, Seattle, Wash., is having plans prepared for a commercial garage and repair shop to be erected on Pike St., near Broadway. Estimated cost, $35,000.

Wesley Henman, Spokane, Wash., is constructing a one-story brick and concrete garage, 50x142 ft., at 2023 Third Ave. It will accommodate 65 cars.

C. R. Seguine, Ontario, Ore., contemplates the construction of a two-story extension, 40x40 ft., to his garage, to be used as a machine and repair shop.

O. Ober, Glendora, Calif., will soon begin the erection of a commercial garage and machine shop on Wall St., Glendora.

The Irrigation Supply Co., Ontario, Calif., will erect a machine shop on East Main St.

The Ford Motor Co., Detroit, Mich., will erect a plant at Los Angeles, Calif., to cost $250,000.

The California Fireproof Door Co., 1932 South Main St., Los Angeles, Calif., will build a factory at Washington and South Main Sts. The building will be four-story brick structure, 200 ft. in length.

The Iowa Iron & Metal Co., Des Moines, Iowa, is negotiating to establish a large foundry at San Diego, Calif. J. Gottstein is general manager.

CANADA

The Pioneer Tractor Mfg. Co., Winona, Minn., maker of traction engines, is planning to build a plant at Calgary, Alta. The estimated cost is $250,000.

The Granby Consolidated Mining & Smelting Co. will erect a smelting plant, at Granby Bay, B. C., to cost about $1,000,000.

McDougal & Jenkins, Vancouver, B. C., are building a plant for the manufacture of boilers, at Coal Harbor, Vancouver.

The Buffalo Union Furnace Co., Buffalo, N. Y., will erect a plant, at Port Colborne, Ont., for the manufacture of pig iron.

Marsh & Henthorne, Belleville, Ont., are planning to erect a foundry and machine shop.

The American Radiator Co., Chicago, Ill., will add four new buildings to its plant, at Brantford, Ont.

The plant of the Standard Iron Co., situated on Bay of Quinte, Deseronto, Ont., was damaged by fire, Mar.7. Loss, $50,000, partly covered by insurance.

The McGregor & McIntyre Co., Toronto, Ont., will erect a structure, 140x400 ft., on Shaw St., to be used to fabricate structural steel.

The Benjamin Electric Mfg. Co., Toronto, Ont., will erect a two-story brick factory on York St., at an estimated cost of $25,000. The contract has been awarded.

The National Body Co., Ltd., contemplates the erection of a two-story brick factory, 300x55 ft., at Windsor, Ont., for the manufacture of automobile bodies. The estimated cost is $35,000.

The Copp Stove Co., Fort William, Que., will improve and enlarge its plant.

The Cockshutt Plow Co., Regina, Sask., will erect a three-story and basement factory, to cost about $120,000. The contract has been awarded.

GENERAL MANUFACTURING

NEW ENGLAND

The plant of the Whitefield Mfg. Co., manufacturer of bobbins, Whitefield, N. H., was totally destroyed by fire, Apr. 7. Loss, $25,000; insurance, $20,000.

A fire in Dry House B of the Robinson-Edwards Lumber Co., at Burlington, Vt., caused a loss of $7000, on Apr. 12.

The New England Gas & Coke Co. has awarded a contract for new works, at Everett, Mass.

The Easthampton Gas Co., Easthampton, Mass., will increase its capital $100,000 for the purchase of new equipment.

The contract for the addition to the factory of the National Blank Book Co., Holyoke, Mass., has been awarded. It will be 30x200 ft., five stories high, of brick and steel. The Samuel M. Green Co., of Springfield, is the architect. Noted Mar. 14.

Fire destroyed the mill building of the Leominster Novelty Co., Leominster, Mass., on Apr. 12. Damage, $10,000.

The New Shoe Co., New Bedford, Mass., will build a new factory and boiler house.

Plans for the new building for the Bias Narrow Fabric Co., Bridgeport, Conn., have been completed and estimates will be made soon. It will be three stories high, of brick and granite trim, 100x100x44 ft. McClintock & Craig, 35 Lyman St., Springfield, Mass., are the engineers.

The Norton Co., Worcester, Mass., manufacturer of emery wheels, will build an addition to its plant.

The Bridgeton Worsted Co., Bridgeton, R. I., will remove to Uxbridge, Mass.

The contract has been awarded for the erection of an addition to the plant of W. S. Mills Co., manufacturer of infants' underwear, in Wells St., Bridgeport, Conn. It will be 47x66 ft., three stories high, of brick, mill construction.

Work will soon be started on a two-story addition, 56x100 ft., for F. K. Bratting, Bridgeport, Conn., manufacturer of dolls and dolls' shoes.

The Collins Co., Collinsville, Conn., will replace a portion of its steam power with a new hydro-electric plant.

The contract for the erection of an addition to the plant of Palmer Bros. in Fitchville, Conn., manufacturers of comfortables, has been awarded. The structure will be 175x90 ft., three stories high, of brick, mill construction.

The sawmill and lumber yard of Henry Cairns, East Hartford, Conn., have been destroyed by fire.

Ice-making machinery and refrigerating plant will be installed in a new three-story building, to be erected on Mulberry St. by Joseph Kashmann & Sons, Hartford, Conn.

The contract for enlarging the plant of the Wilcox & White Co., maker of organs, Meriden, Conn., has been awarded.

Cadworth & Woodworth, architects, will probably have plans for the new plant of American Thermos Bottle Co., Norwich, Conn., ready for bids in about two weeks. It is planned to erect a structure two stories and basement, 100x200 ft., of brick.

MIDDLE ATLANTIC STATES

St. Vincent's Male Orphan Asylum, Western Ave., Albany, N. Y., will erect a $50,000 vocational school to include workshops.

Plans have been filed with the building department for the erection of a four-story brick factory, 103x77 ft., on 38th St., near Fort Hamilton Ave., Brooklyn, N. Y., to cost $35,000. It will be owned and operated by the Joseph Friedland Show Case Co.

Fire gutted the plant of the Empire Provision & Beef Co., at Seneca and Exchange Sts., Buffalo, N. Y., on Apr. 9. Damage to building $20,000, and to contents, $15,000. Covered by insurance.

The Delac Wall Board Co., Caledonia, N. Y., has purchased a site at the junction of the Lehigh Valley Co. and Buffalo, Rochester & Pittsburg Co., and will build a factory at once.

The plant of the J. E. Davis Piano Co., Cortland, N. Y., was destroyed by fire, Apr. 5. Loss, $250,000.

The Concrete Guard Rail Co. is planning to locate at Fishers, N. Y., where it will manufacture its patent guard rail, which is made of concrete with steel reinforcement.

The Tri-Town Electric Co., Glenville, N. Y., recently incorporated, will equip a power plant to supply electric power and light in Glenville, Clifton Park and Ballston and neighboring villages. Among the directors are W. A. Graves, Michael J. Hughes and Samuel M. Strong.

The Geneva Preserving Co. will rebuild its plant recently destroyed by fire, at Geneva, N. Y. Estimated cost, about $160,000. Noted Apr. 4.

The plant of the Johnstown Degreasing Co., Johnstown, N. Y., was totally destroyed by fire, Apr. 6.

The Barnet Leather Co., Little Falls, N. Y., will build a large power house in connection with its plant. The contract has been awarded.

The Little Falls Felt Shoe Co. has let the contract for an addition to its factory at Little Falls, N. Y.

The top floor of the 5-story brick building, at 45 University Pl., New York, occupied by Snyder & Frank, manufacturers of coats and suits, was burned, Apr. 14. Loss, $500.

Fire caused a loss of $50,000 in the building at 49 Elizabeth St., New York, on Apr. 12. The building was occupied by: Grand Steam Laundry Co., Universal Metal Works Co., Brassil Book Binding Co. and Klee Tailoring Co.

The city of Newark, N. Y., will receive bids until Apr. 30 for a sanitary sewerage system and a sewage disposal plant. J. E. Wiser is city clerk.

The Philo-Hay Specialty Co., Newark, N. J., has awarded the contract for the erection of its new factory, 37x175 ft., three stories, of reinforced-concrete construction.

The Empire Kraut & Pickling Co., Phelps, N. Y., will erect a large addition to its plant and will engage in a general canning business in addition to the making of sauerkraut.

Fire destroyed the cheese factory and sawmill owned by A. M. Tarbott, at Rushford, N. Y., on Apr. 10. Loss, $4000; insurance, $1500.

George J. Michelson, manufacturer of furniture, at Syracuse, N. Y., will erect a factory on Ave. E, that city.

The A. E. Nettleton Co., manufacturers of shoes, at Syracuse, N. Y., have leased additional property for factory space in that city, which will afford 25,000 ft. additional floor space.

The Chemic-Alloy Co., Bradford, Penn., manufacturing chemicals and babbitt metals, will establish a plant in Syracuse, N. Y., and concentrate its chemical business in that city. W. R. Chipman is general manager.

The Aetna Wright Health Underwear Co., Troy, N. Y., will erect a four-story addition to its knitting mill. Estimated cost, $25,000.

The Central Milling Co. is erecting a new flour mill, at Wilson, N. Y.

The plant of George F. Lubery, Jr., manufacturer of rubber substitutes, 833-839 Magnolia Ave., Elizabeth, N. J., was damaged by fire, Apr. 13.

The C. Mueller Co., Jersey City, N. J., manufacturer of macaroni, will build an addition to its plant.

Pope Silk Mfg. Co., Paterson, N. J., will erect a new factory at Bayonne, N. J.

The plant of the Carbondale Bottling Works, Carbondale, Penn., was destroyed by fire, Apr. 10. Loss, $30,000.

Plans have been completed for the erection of a broom factory for A. B. Heller, owner of the Acme Broom Works, Hamburg, Penn.

The Russell Box & Lumber Co. is considering plans for the erection of new buildings for its plant upon ground which the company owns on Munson Ave., McKees Rocks, Penn. Estimated cost, $75,000.

Fire in the plant of the Glen Willow Ice Manufacturing Co., Cinnaminson Lane and the Philadelphia & Reading Ry., North Manayunk, Penn., caused loss estimated at $150,000, Apr. 9.

The Electro-Dental Mfg. Co., Philadelphia, Penn., has purchased a site at Arch and Thirty-third Sts., and will erect a large factory.

The Atlantic Oil Refining Co. will build a three-story addition, 93x83 ft., to its plant at 31st and Ritner Sts., Philadelphia, Penn., to cost about $15,000.

The factory of the Ideal Cloak & Suit Co., 44 North Seventh St., Philadelphia, Penn., was damaged by fire, Apr. 12. Loss, $2000.

The Pittsburg Provision & Packing Co., Pittsburg, Penn., has awarded the contract for the erection of a brick and reinforced concrete building to cost $20,000, to be equipped for packing and refrigerating purposes.

The Century Knitting Co., Spring City, Penn., has purchased land in Pottstown, Penn., and will erect a mill, 40x100 ft. The building will be four stories high.

The Pennsylvania Fireproofing Co., St. Marys, Penn., is planning to build another plant.

The contract for the construction of the sewage disposal plant at Warren, Penn., for the Warren State Hospital for the Insane, was awarded Apr. 12.

The Gandy Belting Co., Baltimore, Md., manufacturer of canvass belting, will erect an addition to its plant.

Eudowood Sanitarium, Baltimore, Md., will install a large electric plant.

The contract for the erection of an asphalt mixing plant of steel and concrete construction for P. Flanigan & Sons, 120 East Lexington St., Baltimore, Md., has been awarded. The cost is about $50,000.

The International Cotton Duck Co., 86 Worth St., New York, N. Y., has had plans prepared for a two-story, concrete mill, 100x200 ft., to be erected in Baltimore, Md. About 1000 looms will be installed.

SOUTHERN STATES

The Norfolk Southern R.R. will build a new repair shop at West Munden, near South Norfolk, Va. R. S. Anderson, Norfolk, Va., is superintendent.

The J. L. Stifel & Sons Calico Co., Wheeling, W. Va., will build two additional stories to its plant and will purchase a large amount of new equipment. J. F. Stifel, Wheeling, W. Va., is president.

The Lillian Knitting Mills Co., Albemarle, N. C., will erect an addition to its mill.

The Harborough Mfg. Co. is planning to build a large cotton mill near Bessemer City, N. C.

The Cotton Fibre & Mattress Co., Henderson, N. C., will be incorporated, with $50,000 capital stock, and will erect a modern brick building, including warehouses, to be equipped with machinery for manufacturing jute and cotton fiber and mattresses. Edwin B. Taylor is the general manager.

The factory of the Best Chair Co., at High Point, N. C., was totally destroyed by fire, Apr. 9. Insurance, $31,000.

Frank Wemskie will erect a glass factory at High Point, N. C.

The Marion Mfg. Co., Marion, N. C., maker of hosiery, will erect an addition to its plant, to cost $25,000. About 15,000 spindles will be installed. The estimated cost is $250,000.

The Troy Roller Mills, recently organized, will erect a flour mill, at Troy, N. C. Barna Allen is the president.

The Union Buffalo Cotton Mills, Columbia, S. C., will invest about $150,000 to build and equip a steam-power plant. The equipment will include six return-tubular boilers of 250 hp. each, condensers, pump, 210-ft. smokestack.

Fire destroyed the lumber plant of the Industrial Lumber Co., at Augusta, Ga., on Apr. 9, causing a loss of $70,000, with insurance of $50,000.

The J. P. Stevens Engraving Co., Atlanta, Ga., has purchased a site on Pryor Alley near Ivy St., and will build a five-story concrete factory.

A power house will be constructed at Baxley, Ga., and will install machinery for a water-works and electric-light plant. Wade H. Watson is the mayor.

The Bibb Mfg. Co., Macon, Ga., maker of cotton goods, is planinng to build a four-story building, 212x100 ft., at Columbus, Ga., which will be equipped with new machinery.

The Chickamauga Mfg. Co., Rome, Ga., contemplates building an overall factory, at Decatur, Ala.

C. W. Ellerbee and J. B. Smith will erect a plant, at Lakeland, Fla., to manufacture scrubbing brushes.

William Gomm & G. W. Clifton will erect a canning factory, at Fairhope, Ala.

Fire destroyed the plant of Stralton Bros., manufacturers of all kinds of wooden articles, Greensboro, Ala.

The Interstate Power Co. will erect several factories, at Montgomery, Ala.

A crematory for the disposal of garbage at Woodlawn, Ala., will be constructed. Walter G. Kilpatrick is the city engineer.

The Burdon-Castanera Packing Co., Biloxi, Miss., will erect a canning factory to pack shrimp and oysters. F. B. Castanera is the president and C. A. Desporte, vice-president.

J. W. Simmons, who recently purchased the turpentine business of J. J.

McCants & Son, will move to Poplarville, Miss., and will erect a plant on the New Orleans & Northeastern R.R.

The Loubac Glass Co., New Orleans, La., contemplates enlarging its glass factory.

D. A. McGovern, 2229 Burgundy St., St. Elmo, La., will erect a wagon factory.

The Horine Development Co., Chattanooga, Tenn., will build a cement plant, at Marsh Station, near that city. First a large rock-crushing plant will be installed.

The Economy Bag-Closing Co., Knoxville, Tenn., has been organized, with $10,000 capital stock, for the manufacture of a patented gluing machine. J. E. Miller, J. Allen Smith and others are interested.

The Southern Mercantile Co. has been organized, with $100,000 capital stock, to build a factory, at Memphis, Tenn., for the manufacture of kitchen cabinets. W. H. Burton is in charge.

The Duck River Power Co., Shelbyville, Tenn., will erect three hydro-electric power plants to cost $100,000. J. F. Boyd is the president.

J. E. Gibbs, White Bluffs, Tenn., has purchased a stave mill, at Burns, Tenn., and is in the market for additional machinery for manufacturing tight cooperage stock.

Lewis E. Ball will erect a 2½-story roller mill, 20x40 ft., to cost $3000, at Knob Lick, Ky. J. R. Ball is the architect.

The Richmond Ry. & Electric Co., Richmond, Ky., have organized a $3,000,000 company, which will build a 20,000-hp. hydro-electric plant, at Lexington, Ky. L. B. Herrington is the president.

The Burley Tobacco Society, Lexington, Ky., is planning the construction of a plant, to cost about $2,000,000. It also contemplates the erection of a similar plant in Louisville, Ky.

The Louisville Cereal Mills, Louisville, Ky., will install power equipment for the operation of an addition to its elevator. The boiler house is now under construction.

B. F. Meek & Sons, 1430 South Eighteenth St., Louisville, Ky., are in the market for polishing machinery.

J. W. Mann, who operates a planing mill at Eighteenth and Cedar Sts., Louisville, Ky., will install additional woodworking machinery.

James W. Carter, Middlesboro, Ky., will erect a planing mill in that city.

E. S. Perkins, Russellville, Ky., will open a building-stone quarry, at Bowling Green, Ky. Hoisting and power machinery and an air compressor will be needed.

R. L. Thomas, Winchester, Ky., will erect a plant for the manufacture of hardwood flooring.

George E. Tomlinson will erect a planing mill, at Winchester, Ky., and power machinery will be installed.

MIDDLE WEST

Fire destroyed the factory of the Ohio Turning Co., Cleveland, Ohio, maker of wooden goods.

The directors of the Cleveland & Ohio Ry. Co., Cleveland, Ohio, have authorized the purchase of 220 new motors and the erection of four power substations to cost $500,000.

Skeel Bros. Co., Cleveland, Ohio, will enlarge its wood-working factory.

The Patterson-Sargent Co., Cleveland, Ohio, paint maker, has taken out a permit to enlarge its factory.

The Universal Lubricating Co., Cleveland, Ohio, organized with $100,000 capital by S. W. Schofield, C. B. Emery and others, will erect and equip an oil-refining plant.

The Mooney Belting Co., Cincinnati, Ohio, organized by T. E. Mooney and others, to erect and equip a belt-making plant.

The Gallup-Ruffing Handle Co., Hamilton, Ohio, will erect an addition, 40x60 ft., to its factory.

The flour mill, at Oxford, Ohio, owned by Bert Esley, was destroyed by fire. Loss, $15,000.

The Indianapolis Switch & Frog Co., Springfield, Ohio, has started the erection of the new three-story addition.

The Hancock Mfg. Co., Sandusky, Ohio, is building a new plant near the Lake Shore & B. & O. junction, and will produce and market mold glassware.

The Gendron Wheel Co., Toledo, Ohio, manufacturer of bicycles and go-carts, is building a new factory on Jackson Ave.

The East Side Iron Elevator Co., Toledo, Ohio, is erecting a concrete elevator for the storage of grain.

Emory & Eisenbrey, chemical engineers, Philadelphia, Penn., are receiving bids for the new plant of the North American Chemical Co., at Urbana, Ohio. The building is to be two stories, 117x32 ft., with engine and boiler room and shipping sheds separate. Bids for both reinforced-concrete and brick construction, are being asked. The necessary equipment includes a 100-hp. slide-valve engine, two 125-hp. boilers, pulverizers, conveying machinery, etc.

The Central Indiana Steam Heating Co., Anderson, Ind., will rebuild its plant. Estimated cost, $120,000. O. P. Crim is manager.

A new canning factory will be erected on the old McCloy lamp flue plant, Elwood, Ind.

Work on the new $25,000 three-story plant of the Grocers' Chemical Co., Walnut and Canal Sts., Evansville, Ind., will be commenced early this week.

Eli Lilly & Co., Indianapolis, Ind., manufacturing chemists, will build a factory to cost about $60,000, on Alabama St., near Merrill St.

The Columbia Conserve Co., Indianapolis, Ind., will erect an addition to its factory on Churchman Ave., near the Belt Ry.

The Whitman Handle Co., recently incorporated, at Mt. Vernon, Ind., will soon ask bids for the construction of a large handle factory. William E. Whitman is president.

The Monarch Laundry Co., Detroit, Mich., is erecting a new laundry.

J. J. Walsh, 1205 Chamber of Commerce Bldg., Detroit, Mich., is preparing plans for a new one-story bakery, 79x83 ft., for Walker Bros., 29 Farmer St. The estimated cost is $25,000.

The Sewall Cushion Wheel Co., Detroit, Mich., will increase its capital stock from $60,000 to $300,000.

The Detroit Edison Co., Detroit, Mich., furnisher of electric light and power, is erecting a new power house.

The Lutz & Schram Pickling Co. is building a large pickling plant in Flint, Mich.

Pierce Lindhout, architect, 718 Ashton Building, Grand Rapids, Mich., has awarded the contract for the construction of a four-story and basement factory for the Imperial Furniture Co., Grand Rapids. The estimated cost is $100,000.

Robinson & Campau, 449 Houseman Building, Grand Rapids, Mich., have prepared plans and will soon receive bids for the four-story factory, 110x160 ft., for O. & W. Thum, manufacturers of fly paper, 410 Straight St., Grand Rapids. The estimated cost is $100,000.

The Westfield & Fall River Lumber Co., Ionia, Mich., is having plans prepared for a new two-story lumber mill, 74x130 ft., to cost about $30,000.

Siegle & Plattnittsky will build a two-story brick factory at 2713-15 West Twelfth St., Chicago, Ill., to manufacture office furniture.

Fire damaged the third floor of a four-story brick building, 841-45 West Twenty-second St., Chicago, Ill., occupied by the Radford Sash & Door Co. It will be immediately rebuilt and new machinery will be required.

The Sanitary District, of Chicago, Ill., has let the contract for a brick power station at 3244 West Twenty-second St.

A $200,000 fire in Chicago, Ill., damaged the plants of the Standard Gillett Light Co. and the Innes-Peiden Chemical Co., West Michigan St.

Sears, Roebuck & Co., Chicago, Ill., have had plans prepared and are about to begin the erection of a large addition to their plant.

The Gross Bros. Co., Galesburg, Ill., manufacturer of overalls and shirts, will enlarge its plant.

The Corn Products Refining Co., Peoria, Ill., will improve and enlarge its plant.

Contracts have been awarded by the Warner Instrument Co., Beloit, Wis., for the erection of a large addition, 100x100 ft., to its factory to take care of its speedometer business.

The Hillsboro Wisconsin Light & Power Co., Hillsboro, Wis., will erect a plant to cost about $25,000. F. A. Wopat is the president.

The Phoenix International Light Co., 525-527 Market St., Milwaukee, Wis., has purchased a 40x120-ft. site at 560 East Water St. and proposes to erect a six-story factory of reinforced concrete.

The Winnebago Boat Mfg. Co., Menasha, Wis., was burned. Loss, $7000.

The Heineman Lumber Co. will erect a sawmill, planing mill and wood-working plant, at Merrill, Wis.

The Prairie City Canning Co., Prairie du Chien, Wis., which was recently incorporated, will erect a three-story brick factory. Frid Hur is the architect.

WEST OF THE MISSISSIPPI

The Des Moines Silo Manufacturing Co., Des Moines, Iowa, will erect a plant on the site adjoining the present one at North, Fourth and New York Aves., to make ensilage cutters, silo filler and iron and steel parts used in the construction of silos. It will consist of a foundry, machine shop and warehouse.

The Deep Well Bucket Co., St. Louis, Mo., will build a factory in Council Bluffs, Iowa.

The T & Z Planing Co., Mason City, Iowa, will erect a new plant. The owners are G. A. Tolsend and H. H. Zimmerman.

The McLaughlin-Gormley-King Co., Minneapolis, Minn., which operates a drug and spice mill will erect a four-story brick factory, 60x120. The estimated cost is $30,000.

The Northwestern Knitting Co., Western and Aldrich Aves., Minneapolis, Minn., is building a five-story addition to its plant. The cost is about $100,000.

The Aberdeen Light & Power Co., Aberdeen, S. D., will erect a plant to cost about $100,000.

The Patent Concrete Cistern Co., Grand Forks, N. D., will build a plant for the manufacture of stock pork barrels, cisterns and road culverts.

The Illinois Glass Co. will expend $700,000 for improvements to its plant, at Alton, Mo.

The plant of the Chicago Milling Co., Second and Chouteau Aves., St. Louis, Mo., was damaged by fire, Apr. 8.

The plant of the Broderick & Bascom Rope Co., foot of Douglass St., St. Louis, Mo., was damaged by fire to the extent of $5000, Apr. 9.

The Mechanics Lumber Co., Argenta, Ark., will erect a planing mill.

Bids will be received until May 15, by the Camp Hardy Corporation, Hardy, Ark., at its offices at 1315 Memphis Trust Bldg., Memphis, Tenn., for machinery and equipment for ice making, cold-storage and electric-light and power plant. A reinforced-concrete dam will be constructed across Big Spring River, at Hardy, and a 150-kva. generator, hydraulic turbine and 40-ton refrigerating and ice-making machine will be installed.

The Brenham Compress, Oil, Ice & Light Co., Brenham, Tex., will expend $30,000 to double the capacity of its ice and cold-storage plant.

The Yellow Pine Paper Mill Co., Orange, Tex., is planning to erect a bag factory, to cost between $150,000 and $200,000.

The Teague Cotton Oil Co., Teague, Tex., recently incorporated with a capital of $40,000, will erect a cotton-seed oil mill. S. E. Tucker is president.

The Silver City Electric Power Co., Silver City, N. M., will soon begin the erection of a new ice and cold-storage plant, at Silver City.

The Union Pipe Line & Refining Co., Los Angeles, Calif., is contemplating the erection of a large oil refinery plant, at Albuquerque, N. M. George B. Gerau, Los Angeles, represents the company.

WESTERN STATES

The Trustees Co., Boise, Idaho, recently organized, will soon erect a fruit-canning plant, at Boise, to cost $20,000.

The Utah Light & Railway Co., Salt Lake City, Utah, is building an addition to its steam plant at South Temple St. The estimated cost is $350,000.

G. I. Toevs, Spokane, Wash., is contemplating the erection of a large flour mill, at Spokane. The estimated cost is $100,000.

The Fleischmann Yeast Co., Cincinnati, Ohio, is planning to build a factory at Sumner, Wash. It will cost about $250,000, and will cover about three acres of ground. The main building will be 100x200 ft., the generating building 144x60 ft., the power house 60x40 ft., and 11 other structures will take up the remainder of the space.

Ortweiler & Cummings, Oregon City, Ore., are planning the erection of a sawmill plant on the Major River, near Lyle, Wash. They will also manufacture shingles and boxes.

The Crown-Columbia Pulp & Paper Co., Oregon City, Ore., will erect a large paper mill.

The Southwestern Sugar Co., Corcoran, Calif., will erect a concrete and galvanized-iron warehouse, 40x200 ft., and will also remodel its machinery building, and install new equipment, at a cost of $25,000.

The Hemet Canning Co., Hemet, Calif., will make extensive improvements and additions to its fruit-canning plant. J. M. Frazier is president.

The Longbeach Sash & Door Co., Longbeach, Calif., will build a large addition to its plant, in the Inner Harbor Industrial District. W. M. Brown is president.

F. C. Finkle, engineer, Los Angeles, Calif., is preparing plans for an electric pumping plant for the city water department at Longbeach, Calif.

The Bedell & Ogg Co., Los Angeles, Calif., will erect a reinforced-concrete laundry at Avenue Twenty, near Arroyo Seco, 66x140 ft. Mayberry & Parker, Pacific Electric Building, Los Angeles, are the architects.

A. Fereva, A. C. Fleming and H. S. Williamson, Lincoln, Calif., will erect a fruit-canning plant.

The Sanguinetti Canning Co., Mountain View, Calif., is building a large addition to its factory.

The National City Laundry Co., National City, Calif., will construct a modern steam laundry, at National Ave. and Eighteenth St. F. V. C. Hinman is president.

The city of Red Bluff, Calif., is contemplating the installation of a municipal water and lighting system. Estimated cost of the water system, $85,325, and of the lighting system, $146,668.

The Los Angeles Pressed Brick Co., Los Angeles, Calif., will build additions to its plant at Richmond, Calif. The cost will be about $60,000.

The Associated Oil Co., Wells Fargo Building, San Francisco, Calif., will build a new refinery, at Porto Costa, Calif., estimated to cost $1,250,000.

The Ramona Power & Irrigation Co., San Jacinto, Calif., is having plans prepared for power plants to be constructed in the San Jacinto Valley. Koebig & Koebig, Title Insurance Building, Los Angeles, are the architects.

The Tulare Power Co., Tulare, Calif., will extend its power lines to Terra Bella, Calif., and vicinity. C. H. Jackson is superintendent.

The Pacific Gas & Electric Co., Wheatland, Calif., will erect a new plant at Wheatland.

Canada

The Seal Cove Fish & Cold Storage Co., Prince Rupert, B. C. will erect a camery to cost about $300,000.

The Davis Leather Co., Newmarket, Ont., will construct a new plant at Stratford, Ont., to cost about $164,000. The contract has been awarded.

William Davies & Co., meat packers, 521 Front St., Toronto, Ont., have purchased property on Victoria St., Winnipeg, Man., and will erect a plant.

The Montrose Paper Mills, Ltd., Montrose, Ont., will erect a three-story mill, to cost about $100,000. Bids will be received by D. J. Albertson, 305 East Main St., Kalamazoo, Mich.

Forthcoming Meetings

American Supply and Machinery Manufacturers' Association, National Supply and Machinery Dealers' Association, Southern Supply and Machinery Dealers' Association. Triple convention, May 13-15, Norfolk, Va., Hotel Monticello. F. A. Mitchell, secretary, 309 Broadway, New York City.

Master Boiler Makers' Association. Sixth annual convention, Fort Pitt Hotel, Pittsburg, Penn., May 14-17. J. Rogers Flannery, secretary arrangements committee, Flannery Bolt Co., Pittsburg, Penn.

National Machine Tool Builders' Association. Semi-annual convention, May 16-17, Atlantic City, Hotel Chalfonte. Charles E. Hildreth, secretary, Worcester, Mass.

American Society of Mechanical Engineers. Spring meeting, May 28-June 1. Hotel Hollender, Cleveland, Ohio. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

American Railway Tool Foremen's Association. Annual convention, Chicago, Ill., July 9, 1912. H. L. Mills, secretary, 835 Monadnock Building, Chicago, Ill.

American Society of Engineer Draftsmen. Regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies Building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton Building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Connecticut

PATTERN MAKERS—Six first-class, familiar with heavy machinery work. Farrel Foundry & Machine Co., Ansonia, Conn.

FOREMAN—Thoroughly competent for head of planer department, who is conversant with modern planing methods; references required. The Whitlock Printing Press Mfg. Co., Derby, Conn.

SALESMAN—Must be an engineer accustomed to selling machinery, and not over 35 years old; headquarters will be in St. Louis, with charge of all states south of Illinois and Nebraska; we must have a first-class man. Apply stating experience to Box 218, Am. Machinist.

FOREMAN, to take charge of bolt-threading department; must thoroughly understand thread cutting in all particulars, also the operation of the various types of threading machines, and be competent to manage help; only first-class man need apply. Box 165, Am. Machinist.

DESIGNER—By large Eastern manufacturer of machine tools, machinery and mechanical specialties, a chief designer of proven ability; a record of achievement is essential, and all applicants to receive consideration must be thoroughly explicit in describing their records; past and present employers, age and salary expected should be stated; all applications will be treated with strict confidence and no inquiries regarding any will be made without first consulting applicant. Box 245, Am. Machinist.

Illinois

FOREMAN for tool making department; one with experience in designing tools for working sheet metal in drawing and blanking presses; must be sober, industrious, and of good character; a good opening for the right man. Box 228, Am. Machinist.

WE ARE constantly in need of the services of first-class draftsmen and tracers; some men are required on tool work and it is possible to place some on detailed and assembled drawings of agricultural implements. Applications requested addressed David Bradley Manufacturing Works, Bradley, Ill.

Indiana

HARDENER, one with large experience in hardening all kinds of steel gears. Box 236, Am. Machinist.

Maryland

DRAFTSMAN, experienced in high-speed stationary engines. Box 227, Am. Machinist.

DRAFTSMEN, experienced on dredging machinery and marine work; also competent structural and hull draftsmen. Box 59, Am. Machinist.

Massachusetts

DRAFTSMAN—First-class on cotton-carding machinery. Apply stating age, experience and wages expected, to Box 155, Am. Machinist.

OPERATORS on Potter & Johnston and Gridley automatics; in writing state age, experience and pay desired. Box 156, Am. Machinist.

FOREMAN for milling machine department; an energetic, uptodate man of experience on medium and light work of commercial quality; in writing state wages expected, age and experience. Box 157, Am. Machinist.

DESIGNERS AND DRAFTSMEN, accustomed to rotary and flat-bed printing presses; excellent position for those who can qualify; apply giving former positions and references, salary expected, also age and if married. Box 237, Am. Machinist.

Minnesota

TOOL MAKERS, several, who are familiar with making jigs, fixtures, dies, cutting tools, etc; we are looking for steady, reliable men who desire a permanent position with chance for advancement; the wages to start will be 35c. per hour, 10 hours per day; in making application please give age, experience, reference, etc., in full, or application will not be considered. Box 223, Am. Machinist.

Missouri

SALES ENGINEER, technical graduate, to start in engineering department of concern in Middle West and when familiar with the line of manufacture work himself into sales engineering; experience not essential, but must have ability to develop; must be bright and of good approach; good drawing room, modern shop and estimating experience necessary; state age, previous experience and salary expected. Box 233, Am. Mach.

New Jersey

DRAFTSMEN, preferably with some experience in machine-tool design. Address Box K, Plainfield, N. J.

MECHANICAL DRAFTSMAN, young, for general installations, having some knowledge of electricity; steady position; in answer state capacity, references and salary expected. Box 238, Am. Machinist.

SUPERINTENDENT, capable of taking full charge of large modern shop employing several hundred hands manufacturing fine brass goods and light high-grade electrical machinery; must be practical mechanic in all trades involved and able to train foremen; want man with long, successful record, now employed and making good, who will change only for larger salary and opportunity. Box 224, Am. Machinist.

New York

DRAFTSMAN, familiar with machine tools and automatic machinery; good position for skilled man. Box 249, Am. Machinist.

FOREMAN—Sharp, hustling, uptodate experienced in lubricator and oil-pump work; piece system; give age, experience, reference and salary expected. Box 226, Am. Machinist.

DESIGNER, chief draftsman and four detailers, first-class in automobile work; full particulars of experience, age and salary required. Box 244, Am. Machinist.

TOOL MAKERS, first-class, with experience on accurate steel molds for die castings; good wages and steady work; shop located in Brooklyn. Box 240, Am. Machinist.

MECHANICAL DRAFTSMAN, thoroughly competent, who has a complete knowledge of flour blending, sifting and weighing machinery; give experience, references, salary expected, etc., in first letter. Box 189, Am. Machinist.

Ohio

SALESMAN, gas engine. Box 234, Am. Machinist.

DESIGNER, experienced on lathe and drilling machines with reference; good opening to right man. Box 225, Am. Machinist.

CAPABLE MAN with mechanical experience, familiar with factory costs and efficiency work, by a large manufacturing concern of mechanics' small tools, in the Middle West; good position for right man; give full information as to experience, references, age, married or single, salary expected, etc.; only those qualified for this particular work need apply. Box 212, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

OPERATORS — First-class automatic screw-machine operators, familiar with Cleveland machines; steady work. Apply to Flannery Bolt Co., Bridgeville, Penn.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Wisconsin

ESTIMATOR, capable of setting exact time of operation on small interchangeable and repetition work from blueprints; automobile part experience preferred, though not essential; give full particulars and salary expected. Box 171, Am. Machinist.

FOREMAN, to assist general foreman of tools in automobile-part manufactory; must have thorough knowledge of modern jigs, fixtures, punches and dies, and have successfully held a like position on automobile parts, or equal; state full particulars and salary expected. Box 222, Am. Machinist.

FOREMAN, to take complete charge of grinding section in automobile-part manufactory; must have successfully handled such a position on automobile parts, or equal; this section includes universal, surface and rough grinding, also polishing; state full particulars and salary expected. Box 221, Am. Machinist.

ANALYTICAL CHEMIST and metallurgist, by large manufacturer; we are looking for a man who has thorough knowledge of steels and who has sufficient experience to enable him to supervise work of hardening, tempering, etc.; here is a good opportunity for a first-class man; give all particulars. Address "Automobile," Am. Machinist.

Positions Wanted

Canada

DRAFTSMAN, experienced, with thorough knowledge of manufacturing methods, wants situation, preferably on the road. Box 235, Am. Machinist.

Connecticut

SUPERINTENDENT or assistant, young man, 30, desires to change; past four years factory superintendent for edge tool and cutlery company, four years superintendent for metal stamping company, four years factory cost man; thorough practical knowledge of piece work and premium system; executive ability; thoroughly understands the manufacturing line from the machine shop to the bookkeeping department; have always made good; highest references. Box 229, Am. Machinist.

Illinois

MANAGER of routing, cost and production departments; age 33; ten years' experience; now holding responsible similar position in factory employing 1000 men, building medium weight high-grade machinery; competent to install and apply efficient common-sense methods for obtaining maximum factory production. Box 243, Am. Machinist.

Indiana

IGNITION EXPERT, at present employed by leading firm in this country, would like to make a change; for the last two years assistant superintendent; first-class mechanic and able to get results where precision work is required. Box 230, Am. Machinist.

Massachusetts

FOREMAN, experienced and uptodate on modern methods, desires charge of tool or manufacturing department; tool designer; understand production work thoroughly; progressive; references. Box 241, American Machinist.

GENERAL FOREMAN, American, age 31, desires change; expert mechanic and manager; uptodate methods of tool making and machine manufacturing; thorough knowledge of piece work, premium system and estimating; would like to take charge of small concern where a progressive man is needed; salary, $2000; best references. Box 207, Am. Machinist.

New Jersey

SUPERINTENDENT or assistant; 10 years in present position, six as assistant superintendent with foremost concern in its line; American, age 34; command of German. Box 247, Am. Mach.

New York

MECHANICAL DRAFTSMAN, various experience, wishes position. Box 209, Am. Machinist.

MECHANIC, expert on optical and electrical instruments wants position, the same or as tool maker. Box 242, Am. Machinist.

SUPERINTENDENT and manager of large concern desires change; have made good in present position for nine years. Box 168, Am. Machinist.

TECHNICAL MAN, thoroughly experienced in design, construction and mechanical equipment, ambitious and capable of assuming responsibility, is looking for opportunity with a future. Box 232, Am. Machinist.

SUPERINTENDENT, tool designer; long experience as machinist, draftsman and executive on light and medium weight machinery; recognized ability on practical development of automatic machinery for cheap production of parts, labor-saving devices, etc.; a thorough knowledge of modern production methods; organizer; cost systems; a live wire. Box 246, Am. Machinist.

MECHANICAL ENGINEER, age 40; advanced from shops to foreman, chief draftsman, superintendent, chief engineer, and managing all departments with three millions annual business; energetic and capable in matters of light and heavy forged, cast and sheet metal, and wood manufacturing; power plants, labor, costs, systems, sales and general business; wide experience; modern methods; reasonable compensation based upon conditions. Box 216, Am. Machinist.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

Pennsylvania

MECHANICAL DRAFTSMAN, with considerable shop and designing experience in either evaporating machinery, brewery machinery, pumping machinery, copper and sheet-metal work, heating and coaling apparatus; can speak and write English and German; age 45. Box 231, Am. Machinist.

GENERAL SUPERINTENDENT as manager of a large plant, by a competent man holding similar positions for the last 15 years; thoroughly familiar with the machine business from the foundry to the finished product; large steam and gas engines, turbines, pumps and condensers; can produce good work at moderate cost; have never had any labor trouble. Box 248, Am. Machinist.

Miscellaneous

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Production increased, quality improved. James F. Hobart, efficiency engineer, Box 133, Am. Machinist.

Second-hand foundry pressure blower wanted, size 3, Roots preferred. E. N. Camp & Sons Co., Moreland, Ga.

Radial drill wanted, in first-class condition; 3½-ft. or 4-ft. arm; state make, age, delivery and price. Box 239, Am. Machinist.

Machine shop in New England, fully equipped, wants to contract for small, light machinery; good foundry facilities and can turn out work quickly. Box 153, Am. Machinist.

For Sale—One 8x20-in. Allis-Chalmers Corliss engine; one four-spindle Turner cock grinder; first-class condition. For prices apply to J. E. Lonergan Co., 211 Race St., Philadelphia, Penn.

For Sale—One 4¼ Cleveland automatic machine, also one 2¾ Cleveland automatic, and one No. 1 Brown & Sharpe universal grinder, in first-class condition. Address The Standard Machinery Co., Mystic, Conn.

Machine shops and foundries desirous of manufacturing and marketing a profitable specialty, in the line of fixture, device or machine requiring but little capital, should communicate with the Engineering Service Co., Box 463, Williamsport, Penn.

Machine shop for sale in New England, manufacturing a standard line of well known machine tools; we own the buildings and lot, 75x150 ft., and are a going concern. Box 154, Am. Machinist.

For Sale—Fully equipped plant, situated in Ohio, consisting of brick building of 30,000 ft. floor space and three acres; with this plant is an established business, and the equipment is adapted for the manufacture of machine tools, gas engines, or metal manufacturing, in which gray iron and steel would constitute the product; there are good reasons for selling this first-class proposition, and quick action is necessary. Address J. N. Wilson, Box 187, Am. Machinist.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

Talks With Our Readers

By The Sales Manager

Some are not quite clear as to the kind of matter wanted for our editorial columns and how it is wanted.

Of course the editors must be the sole judges but the following letter received from H. R. Cobleigh, Publicity Manager, International Steam Pump Co., states the case so clearly that we give it to you as it is:

It is not so long since the writer occupied an editor's chair himself that he has forgotten one of the few unpleasant duties that go with it—that of disposing of the matter received from those seeking publicity in the reading columns. The more enterprising the companies from which it emanated the more did it usually prove a nuisance.

Since the writer became one of the offenders himself he has been studying to make his work the least offensive. We want our publicity department to be a "candidate" for the approval and regard of the papers and so have adopted the following "platform."

1st—Not to expect that everything sent out will be printed because we happen to advertise in the publication to which it is sent.

It is a mistaken kindness to us on the part of any editor to use something on that account if it will not interest his readers. In that event it can do us no good and it lowers the standard of the paper and thereby diminishes its value to us and all of its advertisers. That suggests the second plank.

2nd—Not to send anything to a paper that is not of probable interest to its readers and when we make an error of judgment we prefer to be corrected so that we will be less likely to make another. You will always be justified in examining what we send on account of this second plank and also the next.

3rd—Not to syndicate any single piece of matter broadcast. As a rule nothing will be sent to two papers in the same field. Exceptions to this are sometimes justified, but such will be frankly declared, otherwise you are safe in treating our matter as though it were exclusive. We have plenty of good material to go around so that we will not need to send everything to everybody and we will frequently give out purely exclusive stuff. Any suggestions from you as to any special thing you would like to have worked up for you alone will have our careful attention.

4th—To be strictly honest with regard to the facts concerning any article, i.e., we will tell you in each case how we are distributing it and if it will affect your decision with regard to using it we will be glad to tell you exactly who we have given the article to and, when we know, who will use it.

5th—To send out matter in such shape that it can be conveniently prepared for the printer. You will notice that we have not referred to it as "write-ups." The writer has an antipathy for that expression that persists and the characteristics of articles that do belong in that class will be carefully avoided. We will try to handle each subject as you would want it and then we will triple-space the copy so that you can easily change it as much as you like without having to have it rewritten. We aim also to furnish clean plain copy. As most papers prefer to make their own engravings we will always send photographs, or blue prints (for line drawings), but we stand ready to furnish cuts, when they are wanted, of the sizes desired.

6th—To send a "ballot" postcard as per sample enclosed to eliminate the necessity of your dictating a letter in replying, for ofcourse we want to know the "returns" and should therefore like to have your "vote" on each offering.

7th and finally—To cooperate with you in every way possible to our mutual advantage. We make no secret of our motives—that of securing greater publicity for our companies and their products, and we fully appreciate the value of it, but we also know you want the news and think that you will generally find our output good enough to pay for were it from a contributor not otherwise recompensed. There should be no obligations on either side, which brings us back to our first plank stated slightly differently, that we do not expect you to use anything that is not worth to you the equivalent of the publicity it gives us.

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Only reliable products can be continuously advertised.